unless otherwise requested. Hard copies shall be provided as requested by the Engineer. All reports shall be marked with the applicable permit numbers and identifying information as required in the permits. Reports shall include photo documentation of the wetland/s being monitored and shall include a minimum of 3 views from different orientations. Views shall be labeled.

Spring Reports, when required, shall be submitted to the Engineer by July 1 for dispersal to the appropriate permitting agencies.

End of Year Reports (which may serve as the Fall Report) shall be based on inspections that occur prior to October 15th. Reports shall be submitted to the Engineer no later than November 1 of each year.

Monitoring Reports shall be as follows for ***2*** years:

- *MassDEP: 1 Report - end of year*

BASIS OF PAYMENT AND METHOD OF MEASUREMENT

Item 755.76 Wetland Monitoring Reports and associated inspections shall be at the Contract unit price per Lump Sum and shall include all labor, materials, equipment, and all incidental costs required to complete the work. Lump Sum will be paid in equal installments of the Lump Sum divided by the number of reports submitted. Payment shall be upon submittal and acceptance of each report, based on the following schedule: Year 1 = ***2 Reports***

- Year 2 = ***1 end of year report***

Attachment F – Stormwater Management Report
(bound separately)

Attachment G –WQC Submission Plans
(bound separately)

Stormwater Management Report

Replacement of Bridge No. W-38-003 (2NV) Butters Row over MBTA

Wilmington, MA

Prepared for

massDOT

10 Park Plaza
Boston, MA 02116

Prepared by ***Green International Affililiates***
Water Resources/Permitting Group
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876
(978) 923-0400

Date: *February 2023*

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Introduction

This Stormwater Management Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00). Appendix A includes a completed Massachusetts Department of Environmental Protection (MassDEP) Checklist for Stormwater Report, stamped by a professional engineer.

The project follows the guidance presented in the MassDOT Stormwater Handbook (the Handbook), and stormwater management systems are designed in accordance with MassDEP Standards.

The following MassDOT standard methodologies are being employed in this project:

- Use of Macro Approach for Standards 2, 3, and 4 to meet requirements to the maximum extent practicable.

Project Summary

Project Description

The Applicant, MassDOT, is proposing Project 608929 to replace the Bridge No. W-38-003 (2NV) which carries Butters Row over the MBTA Commuter Lowell line/Pan Am Railroad in the Town of Wilmington. The bridge is located on Butters Row in the central part of the Town of Wilmington approximately 300 feet southwest of the Butters Row/Main Street (Route 38) intersection. The project includes the replacement of the Butters Row Bridge No. W-38-003 as well as full depth reconstruction of approximately 700-foot section of the Butters Row that contains the bridge and its eastern/western approaches between the Butters Row/Main Street (Route 38) and Butters Row/Factory Road intersections. The proposed bridge will be constructed in the same location; however, the proposed horizontal alignment will be offset to the west from the existing roadway centerline in the bridge area and will approximately follow the same bearing. As a result of the proposed bridge replacement, a minimum vertical clearance of 18’-6” will be achieved to avoid future train impacts to the bridge superstructure.

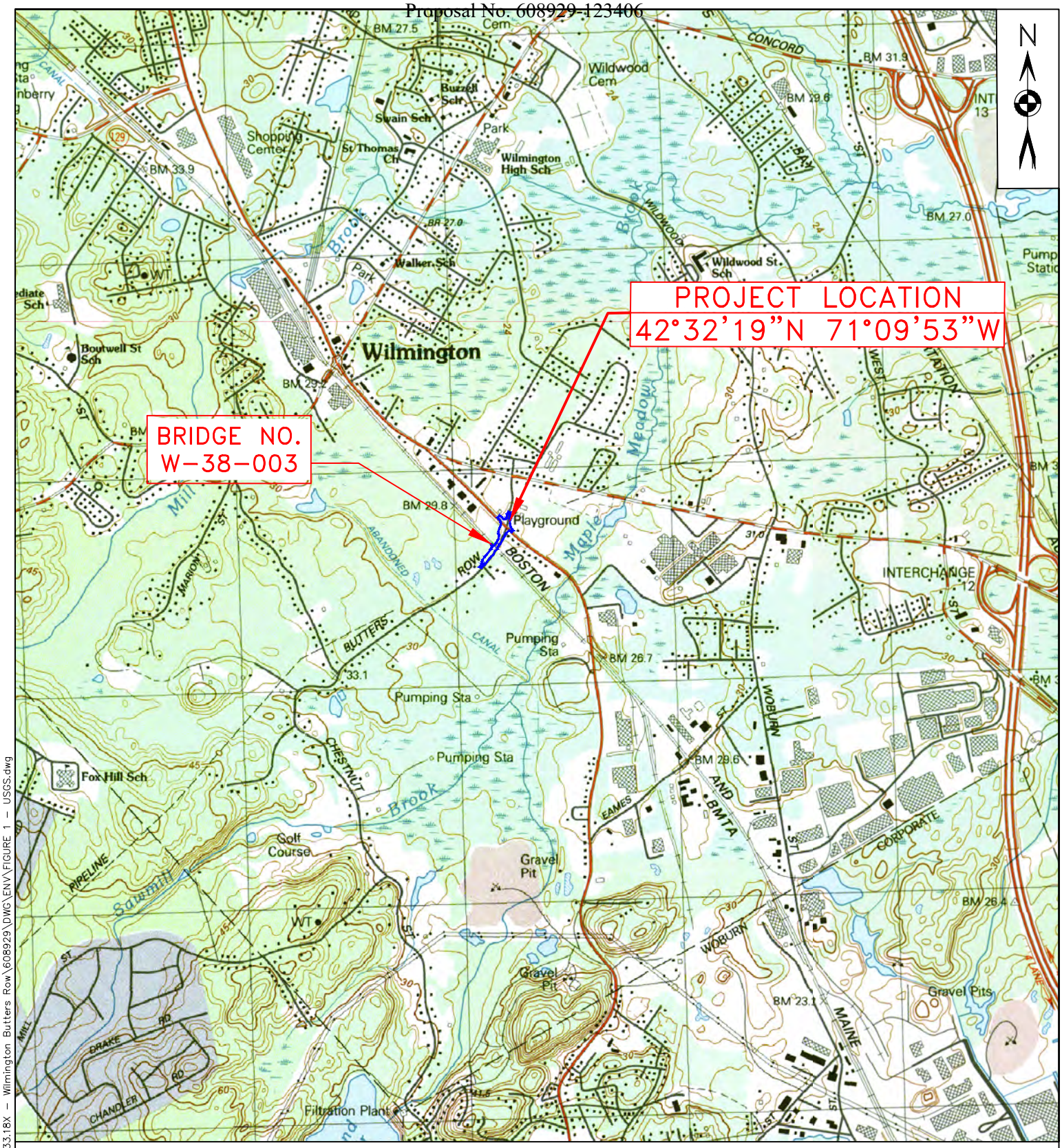
The purpose of this project is to replace the existing Bridge No. W-38-003 (2NV) because the existing bridge is structurally deficient and functionally obsolete. The existing superstructure has a low clearance of 16'-3" over MBTA/Pan Am Railroad, with a history of the bridge being hit multiple times by trains or rail maintenance vehicles.

The project provides an opportunity to improve the existing drainage system and improve the quality of stormwater runoff discharged to adjacent wetlands. This project will incorporate the installation of an infiltrating Best Management Practice (BMP) located near the intersection of Butters Row with Main Street. The goals of the proposed stormwater improvements are to improve public safety on the roadway, to control the flow of stormwater discharged to the wetlands, and to improve the quality of discharged stormwater, to the maximum extent practical.

This project consists of maintenance and improvement of an existing roadway and a bridge (including improvements to existing drainage systems and repaving). As the proposed project is a roadway project, it is therefore categorized as a “Redevelopment Project” under the Massachusetts Stormwater Management Standards. The project is required to meet only Standards 2 & 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 & 6 to the maximum extent practicable.

The following report was created in accordance with the “Massachusetts Stormwater Handbook” last revised in January 2008. The report is organized into sections that correspond to the categories listed in the “Massachusetts Stormwater Report Checklist.” The checklist is included in Appendix A of this report along with a “Redevelopment Checklist.” The following is a more detailed description of the existing and proposed drainage areas and the design methodology for this project.

See Figure 1 for the Project Locus Map.



LEGEND

APPROXIMATE LIMIT OF WORK

SCALE IN FEET

1000 0 1000 2000

ELEVATIONS IN METERS

USGS LOCUS MAP

BRIDGE REPLACEMENT
BRIDGE NO. W-38-003 (2NV), BUTTERS ROW OVER MBTA
WILMINGTON, MA, PROJECT #608929

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
239 LITTLETON RD, WESTFORD, MA (978) 923-0400
24 ALBION RD, LINCOLN, RI (401) 305-7895

PREPARED FOR:
massDOT
Massachusetts Department of Transportation
Highway Division

SCALE: AS NOTED	PROJECT NO. 13033.18X	FIGURE 1
DATE: 6/21/2022	DRAWN BY: OF	
REVISED:	CHECKED BY: MC/DS	

Y:\Shared\Engineering\Projects\2013\13033\13033.18X - Wilmington Butters Row\608929\DWG\ENV\FIGURE 1 - USGS.dwg

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Existing Conditions

The existing site can be analyzed as 5 watershed areas that contribute runoff to 5 discharge points. The existing drainage areas are delineated in Figure 6 – Existing Watershed Plan. For the purpose of this hydrologic analysis, the following assumptions were made:

- When the watershed boundary fell outside of the limit of work an arbitrary line was delineated as the watershed boundary.
- The total watershed area for the existing conditions is used as the comparison base for the watershed area in the proposed conditions.

The existing bridge is located on Butters Row approximately 300 feet southwest of the Butters Row/Main Street (Route 38) intersection in the Town of Wilmington. The area surrounding Bridge No. W-38-003 (2NV) is relatively flat and rural, with forested land, forested and non-forested wetlands with some low-density residential properties around the project limits. Butters Row is a two-lane, two-way road classified by MassDOT as an Urban Collector and is owned and maintained by the Town of Wilmington, with the exception of approximately 67 feet of the roadway including the Bridge No. W-38-003 (2NV), which is under MassDOT jurisdiction. The roadway in the vicinity of the project area provides generally east-west movements connecting to Route 38 (Main Street) northeast of the project limits and Chestnut Street southwest of the project limits in the Town of Wilmington. The road has an average traffic flow of approximately 2,809 vehicles per day, with 1.4% being truck traffic. The posted speed limit is 25 mph in both directions. In the area of the single-lane portions of the eastern and western approaches, the posted speed limit is 15 mph. At present, there are no dedicated bicycle accommodations on the roadway or the bridge.

The existing Bridge No. W-38-003 (2NV) is a three-span simply supported structure with an overall length of 66’-5” and an overall width of approximately 15’-5”. The spans vary in lengths and are 20’-10”, 26’-4” and 19’-3” long respectively. The structure has a curb-to-curb width of 13’-6” feet with chain link fence mounted to the back of timber safety curbs along both sides of the roadway. The bridge carries one (1) 13’- 6” wide travel lane, serving both directions, with no shoulders or sidewalk on either side. Convex mirrors are present on each side of the bridge to aid motorists in seeing oncoming traffic on the other side of the bridge. There are no roadway markings on the bridge. The existing horizontal clearance from centerline of railroad track to face of structure does not meet standards (7’-0” west/ 6’-10” east). The bridge substructure is in fair condition overall, with the bridge seats and backwalls in satisfactory condition, and the breastwalls and wingwalls in fair condition due to extensive cracking, spalling, and scaling. There are several overhead utilities running along Butters Row. Overhead wires on the bridge run on the west side of the road.

Under existing conditions, surface runoff on Butters Row is distributed by “country drainage” off the pavement edges. The existing site can be analyzed as 5 watershed areas contributing runoff to 5 discharge points. There is an existing 30-inch diameter concrete pipe on the western side of the bridge that connects a vegetated wetland on the west side with an intermittent stream on the east side of Butters Row. There are no separate closed drainage systems within the project limits.

Protected wetland resource areas are located on both sides of Butters Road adjacent to the project limits. All vegetated wetlands and streams on site belong to the Ipswich River headwaters watershed within the major Charles River Basin.

There are 5 points within the limit of work where stormwater sheet flows off the roadway via country drainage or via gutterline along existing curb. These locations were analyzed as Discharge Points during the hydrologic analysis, as indicated on the attached Watershed Plan. Brief descriptions of each contributing area are below.

DRAINAGE AREA EDA-1

- This area consists roughly equal parts impervious and grass areas. The impervious areas include portions of Route 38 and Cross street (approximately 200-foot-long section of Cross Street and 300-foot-long section of Route 38). Only half of Cross Street is included within this area. The drainage areas also include grassy areas adjacent to the roadways. Runoff discharges on Route 38, travels via gutter flow to the west, and eventually collects in a catch basin located outside the project limits that discharges into "Wetland D" (DP-1). On Cross street runoff discharges via sheet flow into the grassy areas and into the “Wetland D”

DRAINAGE AREA EDA-2

- This area includes the southwest corner of Butters Row and Route 38 intersection and consists of mostly pervious area. This area encapsulates the west half of Butters Row from the middle of the existing bridge structure to the intersection with Route 38. It also includes the southwestern half of Route 38 extending roughly 250 feet northwest along the road. The pervious area consists of the wooded area west of the two roads. Stormwater runoff discharges via country drainage into the western wooded area and then into “Wetland C/B” (DP-2).

DRAINAGE AREA EDA-3

- This area includes the southeast corner of Butters Row and Route 38 intersection. The impervious area consists of the eastern half of Butters Row from the middle of the existing bridge structure to the intersection with Route 38. Also included is a roughly 50-foot section of Route 38 extending southeast of the intersection. The grassy areas adjacent to the roads area make up the pervious area. Stormwater runoff discharges via country drainage to the east offsite (DP-3).

DRAINAGE AREA EDA-4

- This area consists of the southwest portion of Butters Row located south of the bridge. The impervious area consists of the western half of Butters Row that extends from the center of the existing bridge structure up until roughly 50 feet beyond Factory Road. The pervious area is made up by the wooded area adjacent to the roadway. Stormwater runoff discharges along a naturally created landscaped berm to the south before it concentrates its flow and discharges off the roadway to the west via overland flow into “Wetland C” (DP-4).

DRAINAGE AREA EDA-5

- This area consists of the southeast portion of Butters Row located south of the bridge. The impervious area is made up of the eastern half of Butters Row from the center of

the existing bridge until roughly 50 feet beyond Factory Road. The pervious area is made up of the grassy and wooded area adjacent to the roadway. Stormwater runoff discharges via country drainage flow to the east into an intermittent stream (DP-5).

Table 1 presents the existing drainage areas and their characteristics. Figure 2**: Existing Watershed Plan** shows existing drainage patterns and delineations by design point.

Table 1: Existing Drainage Areas

Drainage Area	*Design Point*	*Area (acres)*	*Curve Number*
EDA-1	*DP-1*	*0.49*	*74*
EDA-2	*DP-2*	*0.69*	*76*
EDA-3	*DP-3*	*0.18*	*74*
EDA-4	*DP-4*	*0.43*	*63*
EDA-5	*DP-5*	*0.20*	*72*

Key features in and around the Project Area include protected wetland resource areas that are located in the northwest, southwest and southeast. All vegetated wetlands and intermittent streams on site are associated with the Ipswich River headwaters watershed within the major Charles River Basin. See Figure 6 - Existing Watershed Plan showing the existing drainage patterns and key features. Wetland resources within the Project area are listed in Table 2.

Table 2: Wetland Resource Areas

Wetland Resource Area	*Wetland Type*	*Description*
Wetland C	*VW*	*DP-4*
Wetland C-B	*VW*	*DP-2*
Wetland D	*VW*	*DP-1*

The Project is not located within the 100-year floodplain as shown on the FIRM community panel 25017C0291E, dated 06/04/2010 as shown on Figure 4, included in Appendix B.

Review of the NRCS Soil Survey map of the Project area identified Swansea muck (HSG B/D), Freetown muck (HSG B/D), Windsor loamy sand (HSG A), Deerfield loamy fine sand (HSG A), Montauk fine sandy loam (HSG C), Udorthents, sandy, and Udorthents, wet substratum. On-site subsurface investigations performed at the Project area by Lamson Engineering Corporation included recommendations for substructure foundation types for the proposed bridge. Appendix B provides detailed soils information, including the NRCS soil survey data for the Project area and results of on-site subsurface investigations.

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WILMINGTON
BUTTERS ROW OVER MBTA

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	2
PROJECT FILE NO.	608929		

EXISTING WATERSHED PLAN - 1

FIGURE X - EXISTING WATERSHED AREAS.DWG Plotted on 29-Jun-2022 4:23 PM

Proposal No. 608929-124046

A00840 - 88

N

EDA-4

DP-4

EDA-2

DP-5

EDA-5

DP-3

EDA-3

MBTA RAILROAD

BUTTERS ROW

BUTTERS ROW
CONSTRUCTION ℄

FACTORY ROAD
(PRIVATE - 40' WIDE)

APPROXIMATE LOCATION OF ATT TELEPHONE LINE. SEE UTILITY NOTE 8 FOR MORE INFORMATION

JANUARY 31,1975 EASEMENT LINE COMMONWEALTH OF MASSACHUSETTS BRIDGE MAINTENANCE EASEMENT (BOOK 2172 PAGE 528)

APPROXIMATE EASEMENT LINE CHAPTER 634

APPROXIMATE CHAPTER 634 EASEMENT LINE

BRIDGE NO. W-38-003 (3MVX)

100-FOOT WETLAND BUFFER ZONE

30"S BC INTERCEPTOR

SMH (REC) INV.=69.25(REC)

SMH RIM=98.98 INV.=69.23(REC)

SMH (REC) INV.=69.21(REC)

VCONC" EL=84.85

CONC" EL=83.23'

WF#C1 WF#C2 WF#C3 WF#C4 WF#C5 WF#C6 WF#C7 WF#C8 WF#C9 WF#C10 WF#C11 WF#C12 WF#C13

WF#IB1 WF#IB2 WF#IB3 WF#IB4 WF#IB5 WF#IB6

WF#/C-29 WF#/C-30 WF#/C-31 STOP WF#B19 WF#B20 WF#B21

CONTINUED ON SHEET NO. 14

LEGEND

- LIMIT OF WORK
- WETLANDS
- 100-FT WETLAND BUFFER
- NRCS SOIL SURVEY BOUNDARY
- EXISTING WATERSHED BOUNDARY
- EXISTING WATERSHED NUMBER — EDA-1
- DESIGN POINT — DP-1

0 20 50 100

SCALE: 1" = 20'

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WILMINGTON
BUTTERS ROW OVER MBTA

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	2
PROJECT FILE NO.	608929		

EXISTING WATERSHED PLAN - 2

FIGURE X - EXISTING WATERSHED AREAS.DWG Plotted on 29-Jun-2022 4:24 PM

Proposal No. 608929-123406

A008340 -90

DP-2

DP-1

N

MAIN STREET (ROUTE 38)
(PUBLIC - 1910 STATE HIGHWAY LAYOUT)

CROSS STREET
(1951 COUNTY LAYOUT - 40' WIDE)

BUTTERS ROW

EDA-2

EDA-1

EDA-3

DP-3

PROP 20' GUY (BO)

PROP UP & 20' GUY (BO)

APPROXIMATE LOCATION OF ATT TELEPHONE LINE. SEE UTILITY NOTE 8 FOR MORE INFORMATION

JANUARY 31,1975 EASEMENT LINE COMMONWEALTH OF MASSACHUSETTS BRIDGE MAINTENANCE EASEMENT (BOOK 2172 PAGE 528)

RY 31,1975 EASEMENT LINE COMMONWEALTH OF

CONTINUED ON SHEET NO. 13

SMH
RIM=88.53
~~BOLTED~~ SHU
INACCESSIBLI

SMH
RIM=97.24
INV.(A)=87.25
INV.(B)=87.30
SUMP=87.27

APPROXIMATE LOCATION OF LINE OF 2' DIA. BOULDERS

APPROXIMATE LOCATION OF LINE OF 2' POST

0 20 50 100

SCALE: 1" = 20'

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Proposed Conditions

The proposed stormwater management analysis can be summarized as 8 watershed areas that contribute runoff to 5 discharge points. The overall watershed area and discharge points of analysis are the same in the proposed condition as in the existing condition. The proposed drainage areas are delineated in Figure 7 – Proposed Watershed Plan.

The proposed bridge will be constructed in the same location; however, the proposed horizontal alignment will be offset to the west from the existing roadway centerline in the bridge area and will approximately follow the same bearing. As a result of the proposed bridge replacement, a minimum vertical clearance of 18'-6" will be achieved to avoid future train impacts to the bridge superstructure.

The proposed bridge will be a simply supported single span structure with a span length of 40'-3", a curb-to-curb width of 32'-0" feet and an out-to-out width of 45'-6" feet. The proposed superstructure will consist of 7 steel rolled beams with an 8" full depth cast-in-place composite concrete deck and a 3" superpave wearing surface. Beams will be spaced 6'-9" on center with 2'-6" overhangs. The existing piers and abutments will be removed, and the proposed abutments will be installed within the existing first and third spans to provide the required horizontal clearances from the railroad. The proposed abutments will be reinforced concrete cantilever type abutments and will require filling in the remainder of the existing first and third spans for the approach roadway. Proposed wingwalls/retaining walls will be u-type walls to tie into the approach roadway grading and contain the proposed fill. The new cantilever abutments will be supported on reinforced concrete pile caps and drilled micropiles with sockets into bedrock. The proposed bridge will carry two 11-foot wide travel lanes, one in each direction, two 5-foot shoulders and two 5'-6" sidewalks on both sides. There will also be a cantilever retaining wall supported on micropiles constructed along the NW approach to maintain the access road below. Work will also include installation of granite curb and concrete sidewalks and guardrail. Butters Row will have a curb-to-curb width of 32'–0" with a total roadway width of 43'-0". It will carry two 11-foot travel lanes, one in each direction, 5-foot shoulders, and 5'-6" wide sidewalks (including curb). Since Butters Row is an Urban Collector with a relatively low design speed of 25 mph (15 mph on the bridge), no special provisions will be made for pedestrian traffic. Pedestrians and bicycles will be accommodated on the roadway as per existing conditions. Butters Row will be closed during demolition of the existing bridge and construction of the proposed bridge. The detour around the work site will utilize Chestnut Street, Burlington Avenue, and Main Street (Route 38).

The project also provides a modified drainage collection system to address the changes caused by the proposed road improvements as well as protecting the nearby downstream watershed and the environment. The proposed drainage improvements include installation of new deep sump catch basins, new drain manholes and new drainage outfalls, as well as proposed infiltration bioretention basin Best Management Practices (BMPs) to mitigate the increase in peak rates of runoff.

The proposed drainage improvements include installation of new catch basins, new drainage manholes and new drainage outfalls, as well as one proposed infiltration BMP to provide stormwater treatment and mitigate rise in peak rates within the project limits.

Each of the watershed areas were analyzed as a Discharge Point during the hydrologic analysis, as indicated on the attached Watershed Plan. The stormwater approach maintains existing drainage and grading patterns to the maximum extent possible.

DRAINAGE AREA PDA-1

- The impervious area includes Cross Street from roughly 150 feet away from the proposed intersection with Route 38 until the intersection, excluding a small portion of Cross Street at the northern side of the intersection. Also included is a roughly 175-foot section of Route 38 from the proposed intersection extending southeast. Only the northeastern half of road is included. The pervious area consists of the grassy areas adjacent to Cross road and the aforementioned section of Route 38 are also included in this drainage area. Stormwater travels via country flow to “Wetland D” (DP-1).

DRAINAGE AREA PDA-2A

- This area consists of predominantly pervious surface located west of Butters Row. It consists of the wooded area north of the train tracks along the proposed Butters Row roadway up until the western corner of the proposed intersection with Route 38. There is a small impervious section that is made up of the proposed bridge abutment on the south side of the drainage area. Stormwater discharges via sheet flow into “Wetland C/B” (DP-2).

DRAINAGE AREA PDA-2B

- This area consists mostly of impervious area, but also includes the proposed bioretention basin (proposed BMP). The impervious areas include Butters Row from proposed intersection with Route 38 to the near edge of the proposed bridge. A section of Route 38 is also included on the southern half of the road. The BMP along with other grassy areas are located at the southern corner of the proposed intersection of Route 38 and Butters Row. A section of a gravel driveway is also included. Stormwater discharges via gutter flow and closed drainage to the proposed BMP, then outfalls to “Wetland C/B” (DP-2).

DRAINAGE AREA PDA-2C

- This area consists mostly of impervious areas. The impervious area is made up of a roughly 150-foot section of Route 38 that begins at the center of the proposed intersection with Butters Row and extends northwest. The pervious areas consist of grassy and wooded areas adjacent to the roadway. Stormwater travels via gutter flow to a closed drainage system that outfalls to “Wetland C/B” (DP-2).

DRAINAGE AREA PDA-3

- This area consists predominantly of pervious areas. This area is the grassy area south of the proposed BMP and is adjacent to the northern section of Butters Row. It also includes part of a gravel driveway. There is a small impervious section that consists of part of the abutment along Butters Row from the proposed bridge. Stormwater discharges through the pervious area to the east offsite (DP-3).

DRAINAGE AREA PDA-4A

- This area consists mostly of pervious area to the west of Butters Row beginning approximately 50 feet past Factory Road up until the far side of the proposed bridge. The pervious surface consists of wooded and gravel areas adjacent to the roadway. Also included is a small impervious area that consists of part of the proposed bridge abutments adjacent to the Butters Row. Stormwater runoff discharges via sheet flow into "Wetland C" (DP-4).

DRAINAGE AREA PDA-4B

- This area consists of Butters Row and extends from the northern end of the proposed bridge until roughly 75 feet before Factory Road. This area only consists of the roadway and adjacent sidewalks. Installation of curb and a closed drainage system is required with the addition of the new sidewalk. Stormwater discharges via gutter flow and a closed drainage system to an outfall located upgradient of "Wetland C" (DP-4). The new piped outfall mimics where there is an existing concentrated discharge into Wetland "C".

DRAINAGE AREA PDA-5

- This area consists of the southernmost portion of Butters Row within the project limits. The impervious area is composed of a roughly 125-foot section of Butters Row, along with adjacent sidewalks, that roughly centers on the intersection with Factory Road. The pervious area consists of the grassy and wooded areas, south of the existing train tracks. Stormwater discharges to the east via country drainage and overland sheet flow into an intermittent stream (DP-5).

Table 3 presents the proposed drainage areas and their characteristics under proposed conditions. See Figure 7 - Existing Watershed Plan showing the existing drainage patterns and key features.

Table 3: Proposed Drainage Areas

Drainage Area	*Design Point*	*Area (acres)*	*Curve Number*
PDA-1	*DP-1*	*0.38*	*79*
PDA-2A	*DP-2*	*0.13*	*51*
PDA-2B	*"*	*0.56*	*85*
PDA-2C	*"*	*0.19*	*84*
PDA-3	*DP-3*	*0.09*	*56*
PDA-4A	*DP -4*	*0.17*	*62*
PDA-4B	*"*	*0.28*	*98*
PDA-5	*DP-5*	*0.18*	*80*

Table 4 presents the change in impervious coverage per Discharge point.

Table 4: Change in Impervious Land Coverage Areas

Design Point	*Existing Impervious (acres)*	*Proposed Impervious (acres)*
DP-1	*0.250*	*0.228*
DP-2	*0.159*	*0.549*
DP-3	*0.093*	*0.003*
DP-4	*0.116*	*0.293*
DP-5	*0.091*	*0.116*

Table 5 lists the proposed SCMs and provides a description of each.

Table 5: Proposed SCMs

SCM	*Description*
Bioretention Basin #1	*Stormwater runoff from PDA-2B is directed to this basin, which discharges to the east into "Wetland C-B" at DP-2.*

WILMINGTON
BUTTERS ROW OVER MBTA

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	2
PROJECT FILE NO.	608929		

PROPOSED WATERSHED PLAN - 1

BEGIN PROJECT
PROJECT NO. 608929
BEGIN PAVEMENT FINE MILLING AND RESURFACING
STA 50+22.00
N 3021223.2821
E 746285.1202

END PAVEMENT FINE MILLING AND RESURFACING
BEGIN FULL DEPTH PAVEMENT
STA 51+00.00

PDA-4B
PDA-2A
PDA-4A
PDA-5
PDA-3
PDA-2B
DP-4
DP-5
DP-3

MBTA RAILROAD

PROP. CB (1-4)
4 LF - 12" RCP
PROP. DMH (1-5)
PROP. FES (1-9)
32 LF - 12" RCP
PROP. DMH (1-3)
108 LF - 12" CLASS V RCP
PROP. CB (1-2)
97 LF - 12" CLASS IV RCP
24 LF - 12" CLASS IV RCP
PROP. CB (1-1)
26 LF - 12" RCP
PROP. CB (1-8)
108 LF - 12" CLASS V RCP
PROP. DMH (2-2)
PROP. CB (2-1)
17 LF - 12" RCP
BRIDGE NO. W-38-003 (2MV)
PROP. CB (2-3)
6 LF - 12" RCP

BUTTERS ROW
BUTTERS ROW CONSTRUCTION
50+00 (PUBLIC)
51
52
53
54
55

FACTORY ROAD
(PRIVATE - 40' WIDE)

APPROXIMATE LOCATION OF ATT TELEPHONE LINE. SEE UTILITY NOTE 8 FOR MORE INFORMATION.
JANUARY 31,1975 EASEMENT LINE COMMONWEALTH OF MASSACHUSETTS BRIDGE MAINTENANCE EASEMENT (BOOK 2172 PAGE 528)
APPROXIMATE CHAPTER 634 EASEMENT LINE

CONTINUED ON SHEET NO. 14

LEGEND

- LIMIT OF WORK
- WETLANDS
- 100-FT WETLAND BUFFER
- NRCS SOIL SURVEY BOUNDARY
- PROPOSED WATERSHED BOUNDARY
- PROPOSED WATERSHED NUMBER (PDA-1)
- DESIGN POINT (DP-1)

0 20 50 100
SCALE: 1" = 20'

FIGURE X - PROPOSED WATERSHED AREAS.DWG Plotted on 29-Jun-2022 4:04 PM

Proposal No. 608929-123406

A00840 - 96

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WILMINGTON
BUTTERS ROW OVER MBTA

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	2
PROJECT FILE NO.	608929		

PROPOSED WATERSHED PLAN - 2

FIGURE X - PROPOSED WATERSHED AREAS.DWG Plotted on 29-Jun-2022 4:04 PM

Proposal No. 608929-12406

A008040-98

DP-2

DP-1

LIMIT OF WORK

N

MAIN STREET (ROUTE 38)
(PUBLIC - 1910 STATE HIGHWAY LAYOUT)

PROP 20' GUY (BO)

PROP UP & 20' GUY (BO)

CROSS STREET
(1951 COUNTY LAYOUT - 40' WIDE)

CROSS STREET CONSTRUCTION ℄

END PROJECT
PROJECT NO. 608929
END PAVEMENT FINE MILLING AND RESURFACING

END FULL DEPTH PAVEMENT
BEGIN PAVEMENT FINE MILLING AND RESURFACING

PDA-1

PDA-2C

PDA-2A

PROP. FES (2-8)
PROP. 5' DIA DMH (2-5)
PROP. CB (2-4)
25 LF - 12" DIP
4 LF - 12" DIP
PROP. CB (2-6)
108 LF - 12" CLASS V RCP
73 LF - 12" RCP

BUTTERS ROW

BUTTERS ROW CONSTRUCTION ℄

PROP. DMH (2-2)
PROP. CB (2-1)

CONTINUED ON SHEET NO. 13

PROP. OCS (2-1)
BMP1

17 LF - 12" RCP
21 LF - 12" RCP
PROP. CB (2-3)
6 LF - 12" RCP
PROP. FES (2-7)

DP-3

PDA-3

PDA-2B

MAIN STREET CONSTRUCTION ℄

LIMIT OF WORK

APPROXIMATE LOCATION OF ATT TELEPHONE LINE. SEE UTILITY NOTE 8 FOR MORE INFORMATION

JANUARY 31,1975 EASEMENT LINE COMMONWEALTH OF MASSACHUSETTS BRIDGE MAINTENANCE EASEMENT (BOOK 2172 PAGE 529)

100-FOOT WETLAND BUFFER ZONE

APPROXIMATE LOCATION OF LINE OF 2' DIA. BOULDERS

SMH
RIM=88.53
BOLTED SHUT, INACCESSIBLE

SMH
RIM=97.24
INV.(A)=87.25
INV.(B)=87.30
SUMP=87.27

0 20 50 100
SCALE: 1" = 20'

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Impaired Waters and TMDLs

Table 6 As described under the Proposed Conditions section, the Project will discharge to Vegetated Wetlands (VWs), resulting from permanent construction and temporary work taking place along Butters Row and Route 38 intersection with Butters Row and Cross Street. Vegetated Wetlands are present on the west side of the bridge along the entire segment of Butters Row within the project limits. There is also an intermittent stream on the southeast side of the bridge, which is hydrologically connected with the wetland system on the west side under Butters Row via a 30-inch diameter concrete pipe at approximate Sta. 53+00. The proposed work will not affect any perennial or intermittent streams present in the vicinity of the bridge or Butters Row; no work on stream crossings is required to construct the bridge and proposed roadway improvements and stormwater mitigation measures. A MassDOT Water Quality Data Form (WQDF) was completed for the project and is included in Appendix C. The WQDF assists in the identification of impaired waters and TMDL requirements and quantifies the pollutant reduction provided by the Project's SCMs.

Table 6 lists the receiving water bodies that are impaired, if the water body is covered by a TMDL, and the TMDL's Waste Load Allocation (WLA) for MassDOT property.

Table 6: Impaired Waters and TMDL Information

Water Body	*MassDEP Category*	*303(d) list Impairments*	*TMDL*	*TMDL Pollutant*	*TMDL Name*	*Waste Load Allocation for MassDOT (lbs/yr)*
Maple Meadow Brook	*5*	*(Dewatering*) Dissolved Oxygen*	*No*	*N/A*	*N/A*	*N/A*

Table 7 lists each water body and the proposed SCMs within its watershed. It also provides each SCM's estimated amount of removal per year, the MassDOT pollutant load before the project, and the MassDOT pollutant load after the project is constructed.

Table 7: Pollutant Removal at Watershed Scale

Water Body	*SCM*	*Removal (lbs/yr)*
Name		
	N/A	*N/A*
	Total Provided by SCMs	*N/A*
	MassDOT Load Before Project	*N/A*
	MassDOT Load After Project	*N/A*

Stormwater from the proposed project does not discharge to any perennial or intermittent streams or waterbodies with a TMDL, so TMDL removal calculations were not performed. See Standard 4 for more detailed water quality calculations and discussions.

Stormwater Management Standards

As demonstrated below, the proposed Project complies with MassDEP Stormwater Management Standards. The Project is considered a redevelopment project and only meets Standards 3 and 4 to the maximum extent practicable.

Standard 1: No New Untreated Discharges

No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The Massachusetts Stormwater Handbook, Standard 1, requires that the project demonstrates that there are no new untreated discharges and that new discharges will not cause erosion or scour to downstream wetlands.

The project has been designed to comply with Standard 1. All new outfalls are designed with flared end sections and rip rap protection to prevent erosion to the existing wetland systems. Stormwater runoff will be treated by deep sump hooded catch basins, and the project includes a bioretention basin with a forebay to provide additional treatment.

Standard 2: Peak Rate/Flood Control

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Standard 2 requires that the rates of flow be attenuated for the proposed development condition. This project is a redevelopment project and is required to meet Standard 2 to the maximum extent practicable.

The peak flow rates were calculated for the 2-, 10-, and 100-year storm events under proposed conditions and compared to the existing peak flow rates. There is an overall net increase in impervious area due to the reconfiguration of the roadway geometry and bridge widening. There is an increase in peak rates for DP-2, DP-4, and DP-5 for some or all storm events. The increase in peak rates translates to a small impact to the corresponding downstream wetland. There is a net decrease in peak rates at DP-1 and DP-3, which represents an improvement on existing conditions. The following is a summary of each DP that has a peak rate increase:

DP-2 discharges to Wetland B-C, which has an approximate area of 2.07 acres. There is an increase in peak rates at DP-2 equal to 0.54 cfs, 0.44 cfs for the 10- and 100-year storms, respectively. The total peak volume for the 100-year storm event will result in a net increase of 0.167 af, which results in an increased depth of approximately 0.97 inches. The result in peak rates are not only less than 0.6 cfs, and the increase depth of runoff is less than 1 inch for the 100-year storm; therefore, the impacts are negligible.

DP-4 discharges to Wetland C, which has an approximate area of 12.78 acres. There is an increase in peak rates at DP-4 equal to 0.75 cfs, 0.93 cfs, and 1.09 cfs for the 2-, 10-, and 100-year storms, respectively. The total peak volume for the 100-year storm event will result in a net increase of 0.106 af, which results in an increased depth of approximately 0.10 inches. The result in peak rate is approximately 1 cfs; however, the increase in depth of runoff is 0.10 inches, which is negligible.

DP-5 discharges to an unnamed intermittent stream. There is an increase in peak rates at DP-5 equal to 0.10 cfs, 0.12 cfs, and 0.11 cfs for the 2-, 10-, and 100-year storms respectively; however, these minor increases are negligible.

Per MassDOT Requirements, a proposed stormwater BMP must hold peak volumes up to the 10-year storm event. The proposed bioretention basin meets this requirement to the maximum extent practicable.

Table 8 provides a summary of peak rates for each design point under existing and proposed conditions. Appendix E provides computations and supporting information regarding the hydraulic and hydrologic modeling.

Table 8: Peak Discharge Rates (cfs)

	Existing			*Proposed*		
Design Point	*2-year*	*10-year*	*100-year*	*2-year*	*10-year*	*100-year*
DP-1	*0.60*	*1.42*	*2.88*	*0.60*	*1.28*	*2.43*
DP-2	*0.95*	*2.15*	*4.23*	*0.40*	*2.69*	*4.67*
DP-3	*0.22*	*0.52*	*1.06*	*0.01*	*0.10*	*0.30*
DP-4	*0.21*	*0.77*	*1.90*	*0.96*	*1.70*	*2.99*
DP-5	*0.21*	*0.53*	*1.10*	*0.31*	*0.65*	*1.21*

Standard 3: Recharge

Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the MassDEP Massachusetts Stormwater Handbook.

Standard 3 requires that three computations or demonstrations be fulfilled in order to satisfy the stormwater recharge requirements. They are as follows:

- Impervious Area
- Required Recharge Volume
- Bottom Area Sizing for Bioretention Basins

As stated previously, this project is a redevelopment project and is required to meet Standard 3 to the maximum extent practicable. This project has 31,644 square feet of total existing impervious area within the limit of work. The required recharge volume for the total proposed impervious and the net increase in impervious area is 2,592 cubic feet (CF) and 1,010 CF, respectively. There is a net increase in impervious area of 23,109 square feet under proposed conditions, so there is a recharge volume requirement.

The project has implemented a BMP to maximize recharge at all feasible locations within the project limits. The proposed bioretention basin at DP-2 will provide an improvement on existing conditions as there are presently no stormwater mitigation practices within the project limits.

The Soil Survey Analysis is included in Section 1.1 of this report, Figure 3 Soils Map, and Appendix B Soil Information. A test pit was performed by Lamson Engineering Corporation in August 2020 near the proposed bioretention basin (see appendix B for Geotech report). Groundwater was encountered 10’ below the surface. The surface elevation is 94.5’ at the boring, meaning groundwater was located at approximately elevation 84.5’. The bottom of the proposed bioretention basin is located at elevation 90.5’. Therefore, the bottom of the proposed bioretention basin will have more than a minimum of 2-feet separation to ledge and/or seasonal high groundwater. Based on the NRCS Soil information, the BMP is located within A soils. Therefore, the required recharge calculations were made using A soils and are located in Appendix D of this report.

For the bioretention basin BMP, the contributing impervious areas and its underlying Hydrologic Soil Group were used to estimate the recharge volume lost by development, which was used as their required recharge volume. The recharge storage volume provided by the proposed bioretention basin is 2,112 CF. The bioretention basin provides storage for the required net increase of proposed impervious area but not for the required total proposed impervious area within the site. Therefore, Standard 3 is met to the maximum extent practicable.

The BMPs were designed using the static method, so that the storage available below the first overflow is equivalent or larger than the required recharge volume. Drawdown calculations

were performed to show that the infiltration basin will drain within 72 hours. For this calculation, the RAWLs infiltration rates were used to estimate the recharge potential of the BMP.

Table 9 provides the required recharge volume for the project, and Table 10 provides the provided recharge volumes for each design point. Recharge is only being provided within DP-2.

Table 9: Required Recharge Volume for Project

	HSG A	*HSG B*	*HSG C*	*HSG D*	*Total*
Existing Impervious (sq. ft.)	31,644	0	0	0	51,846
Proposed Impervious (sq. ft.)	51,846	0	0	0	51,846
Net Impervious Area (sq. ft.)	20,202	0	0	0	30,202
Target depth, F (in)*	0.6	0.35	0.25	0.1	-
Net Increase Required Recharge Volume, Rv (cf)					1,010
Total Required Recharge Volume, Rv (cf)					2,592

*Provided by the MassDEP Massachusetts Stormwater Handbook

Table 10: Provided Recharge Volumes by Design Point

	HSG A	*HSB B*	*HSG C*	*HSG D*	*Total*
DP-2 (PDA-2B)					
Required Recharge Volume, Rv (cf)	885	0	0	0	885
Provided Recharge Volume (cf)	2,112	0	0	0	2,112

The infiltration SCM is designed to drain completely within 72 hours.

Appendix B provides soil evaluation information (including the geotechnical report), and Appendix D provides computations, drawdown calculations, and supporting information regarding recharge.

The Macro Approach is being used for compliance with this standard due to constraints at the project site. Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, and the large number of drywells required would be impractical for all design points. Another option was to use proprietary devices at each discharge point for stormwater treatment volume, but due to high cost and the conflicts stated above were not practical for this project.

Standard 4: Water Quality Treatment

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

- *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
- *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the MassDEP Massachusetts Stormwater Handbook; and*
- *Pretreatment is provided in accordance with the MassDEP Massachusetts Stormwater Handbook.*

Standard 4 requires that all stormwater management systems be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The Massachusetts Stormwater Handbook states that this standard is met when:

- Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
- Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

As stated previously, this project is a redevelopment project and is required to meet Standard 3 to the maximum extent practicable. As mentioned in Standard 3, there is a net increase in impervious area and one BMP is proposed as part of this project. It has been designed to provide water quality treatment for the area of impervious surface that it captures. The treatment practice is:

- (1) Bioretention Basin

This standard is met to the maximum extent practicable.

Massachusetts Stormwater Regulations require a “Water Quality Depth” of 1 inch when the project site is located within a “critical area”. This project is located within a Zone II, which is considered a critical area; therefore, a depth of 1” was used for the Water Quality calculations. This project is considered a redevelopment project; one of the objectives of the proposed stormwater improvements is to improve upon the quality of discharged stormwater.

The proposed design aims to improve the water quality by installing a new bioretention BMP. The required water quality volume for the total impervious area within the limit of work is 4,321 CF. The required water quality volume for the net increase in impervious area within the limit of work is 1,684 CF. The required water quality volume for the impervious area that the bioretention basin receives is 1,475 CF. The proposed bioretention basin provides enough volume for the net increase in impervious area, therefore, this standard will be met to the maximum extent practicable. The bioretention basin also exceeds the water quality volume

requirement for the area it is designed to hold, by providing 2,112 CF of storage. See Appendix D for required water quality volume calculations.

The Project has been designed to comply with Standard 4. A Stormwater control measure has been sized to treat the required water quality volume and remove required pollutant load to the maximum extent practicable.

The Project used the SCM WQ Curves, as provided by the WQDF, to determine the treatment depth based on the required TSS and/or TP removal percentage for each SCM. Appendix C provides the WQDF completed for this project. Table 9 shows the SCMs organized by design point with each SCM's corresponding treatment depth and TSS and/or TP treatment removal.

Table 11: Water Quality Treatment Required and Provided by Design Point

Design Point	*Pretreatment*	*Contributing Impervious Area (sf)*	*Treatment Depth (in)*	*% TSS Removal*
DP-1, 3, 5 (PDA-1, -3, -5)				
Untreated Area	*NA*	*15,167*	*NA*	*NA*
Total				*NA*
DP-2, 4 (PDA-2C, -4B)				
Catch Basins	*Deep Sump Catch Basin with Hood*	*18,383*	*1*	*25%*
Total				*25%*
DP-2 (PDA-2B)				
Bioretention Basin	*Forebay & Deep Sump Catch Basin with Hood*	*17,703*	*1*	*89%*
Total				*89%*
Project Total				*40%*

Appendix D provides the MassDEP TSS Removal Calculation Worksheets.

For MassDOT facilities, Long-Term Pollution Prevention Plans (LTPPPs) are implemented at a statewide, programmatic level through the State's highway operation and maintenance program. Appendix F includes the LTPPP for this project.

The Macro Approach is being used for compliance with this standard due to constraints at the project site. An infiltration SCM has been included where feasible within the project limits.

Water quality treatment provided is calculated by design point and an area-weighted average is calculated to obtain the overall water quality treatment provided by the Project. Specifically, the percent reduction for TSS and/or TP provided by the SCMs for each design point is multiplied by the drainage area to that design point, summed for all design points, and divided by the entire drainage area of the project to obtain the Project's provided pollutant reduction. The Project's water quality treatment provides a minimum of 25% removal where closed drainage only is proposed, and more than 80% of removal where the bioretention basin is provided. Overall, the project will provide 40% TSS removal at the maximum extent practicable.

Standard 5: Land Uses with Higher Potential Pollutant Loads

For Land Uses with Higher Potential Pollutant Loads (LUHPPLs), source control and pollution prevention shall be implemented in accordance with the MassDEP Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all LHPPLs cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the MassDEP Massachusetts Stormwater Handbook. Stormwater discharges from LUHPPLs shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Standard 5 does not apply to the Project. There are no land uses with higher pollutant loads within the Project area.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the MassDEP Massachusetts Stormwater Handbook. A discharge is near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

This site discharges within a Zone II, which is considered a "critical area." This standard applies and the project must meet the 1" water quality requirement. This standard is fully met.

Standard 6 requires that all stormwater management systems within a critical area be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS) prior to discharge and that the treatment train shall provide for at least 44% TSS removal prior to discharge to the infiltration structure. The water quality standards for the proposed stormwater system have been addressed in Standard 4 of this report.

Catch Basins with plastic hoods and 4' sumps are proposed throughout the project. The hoods will provide some volume to capture floatable oil, grease, and petroleum hydrocarbons if a spill occurs.

In addition, MassDOT follows established Best Management Practices (BMPs) and operational procedures and has implemented a range of strategies statewide to reduce the amount of road salt used and minimize its environmental impact. Such strategies include the increased use of liquid deicers to pre-wet dry material in order to reduce bounce and scatter and for pre-treating roadways prior to storms when conditions allow. Both of these techniques have been shown to reduce the overall application of sodium chloride. In addition, the use of closed loop controllers, pavement sensors and other equipment allow for more efficient operations.

Standard 7: Redevelopment

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The improvements to Butter's ROW are considered a Redevelopment; therefore, Standard 7 is applicable to this project. Standard 7 requires a redevelopment project to meet Standards 2, 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 and 6 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project provides an opportunity to improve the quality of stormwater runoff discharged to adjacent wetlands. The proposed stormwater enhancements are summarized below:

- There is one BMP proposed as part of this project. A portion of the proposed drainage system has been designed to convey runoff to this BMP for water quality treatment, and attenuation prior to discharge to the surrounding environment. The proposed BMP is a bioretention basin.

- The new drainage system will follow existing drainage patterns by discharging at natural existing discharge points.

A Redevelopment Stormwater Checklist is provided in Appendix A of this report which illustrates which standards have been met to the maximum extent practicable.

Below is a bulleted summary of project compliance to the standards:

- Standard 1 (Untreated Discharges) – Fully Met
- Standard 2 (Peak Rate Control and Flood Prevention) – Maximum Extent Practicable
- Standard 3 (Recharge to Groundwater) – Maximum Extent Practicable
- Standard 4 (80% TSS Removal) – Maximum Extent Practicable
- Standard 5 (Higher Potential Pollutant Loads) – Fully Met
- Standard 6 (Critical Areas) – Maximum Extent Practicable
- Standard 8 (Erosion Sediment Control) – Fully Met
- Standard 9 (Operations and Maintenance) – Fully Met
- Standard 10 (Illicit Discharges) – Fully Met

Standard 8: Erosion and Sediment Control

A plan to control construction related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The implementation of erosion and sediment controls (ESC) during construction is considered a standard practice for all MassDOT projects. ESC will be installed before any land disturbance begins for the Project and will remain in place for the duration of the project. Construction period pollution prevention and erosion and sedimentation control measures will be implemented at the project site to control construction related impacts during construction and land disturbance activities. The General Contractor for the project will be responsible for implementation of the construction period controls.

The project will disturb more than one acre of land during the construction process and will require a NPDES Construction General Permit issued by the Environmental Protection Agency. As a result, the General Contractor will be required to prepare a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP document will satisfy the requirements of the Construction General Permit and the construction period erosion, sedimentation and pollution prevention plan requirements outlined in Standard 8 of the Massachusetts Stormwater Handbook. A SWPPP has not been prepared for inclusion with this stormwater report; however, one will be prepared prior to any construction activities at the site by the General Contractor.

Erosion and sedimentation controls will be employed to prevent the erosion and transport of sediment into resource areas during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

Below is a description of some of the erosion and sediment control measures that will be employed at the project and that will be included in the SWPPP.

Minimize Disturbed Area and Protect Natural Features and Soil

The most important aspects of controlling erosion and sedimentation are limiting the extent of disturbance and limiting the size and length of the tributary drainage areas to the worksite and drainage structures. These fundamental principles will be the key factors in the Contractor's control of erosion on the project site. If appropriate, the Contractor will construct temporary diversion swales and settling basins or use a settling tank. If additional drainage or erosion control measures are needed, they will be located up-gradient from the compost filter tubes and sedimentation fences when possible.

The Contractor is responsible for the maintenance and repair of all on-site erosion control devices. All erosion control devices will be regularly inspected. At no time will silt-laden water be allowed to enter sensitive areas (wetlands, streams, and drainage systems). Any runoff from disturbed surfaces will be directed through a sedimentation process prior to being discharged to the existing on-site drainage system.

The contractor will establish a staging area(s) on areas to be disturbed for the overnight storage of equipment and stockpiling of materials.

In the staging area, the Contractor will have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials will include, but are not limited to, compost filter tubes, sedimentation fence, erosion control matting and crushed stone. As mentioned previously, erosion and sedimentation controls will be employed to minimize the erosion and transport of sediment into resource areas during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

The Contractor is responsible for erosion control on the site and will utilize erosion control measures where needed, regardless of whether the measures are specified on the construction plans or in supplemental plans prepared for the Stormwater Pollution Prevention Plan (SWPPP).

Primary erosion control techniques proposed include compost filter tubes, sedimentation fence barriers, and a stabilized construction entrance. A detailed description of each technique is discussed below.

Best Management Practices (BMPs)

COMPOST FILTER TUBES

Erosion control barriers (compost filter tubes and/or sedimentation fence) will be installed where required prior to the start of construction. These barriers will remain in place until all tributary surfaces have been fully stabilized.

Compost filter tube barriers will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site. In areas where high runoff velocities or high sediment loads are expected, sedimentation fencing may be installed adjacent to the compost filter tubes. This semi-permeable barrier made of a synthetic porous fabric will provide additional protection. The sedimentation fences and compost filter tube barrier will be replaced as determined by periodic field inspection. Compost filter tubes and sedimentation fences will be maintained and cleaned until the tributary area is fully stabilized.

DRAINAGE SYSTEM PROTECTION

Sediment filters (silt sacks) will be installed at all existing and proposed drainage structures and maintained and cleaned as required to maintain their effectiveness. Catch basins, drainage manholes and storm drain pipes will be cleaned of sediment and debris after the completion of construction. Sediment collected in structures will be disposed of properly and covered, if stored on-site. The following construction measures will be implemented to prevent the transport of sediment through the drainage system.

- Any proposed drainage system will be installed from the downstream end to the upstream end.
- Until tributary areas are stabilized, catch basin inlets will be filtered with a silt sack. If intense rainfall is predicted before all tributary areas are stabilized, erosion control

measures will be reinforced for the duration of the storm. Downstream areas will be inspected, and any sediment removed at the end of the storm.

- Unfiltered water will not be allowed to enter pipes from unstabilized surfaces.
- Trench excavation will be limited to the minimum length required for daily pipe installation. All trenches will be backfilled as soon as possible. The ends of pipes will be closed nightly with plywood.
- Silt-laden waters will be intercepted prior to reaching catch basins during construction. Any gross depositions of materials on paved surfaces will be removed.
- Catch basins will be inspected monthly and cleaned in anticipation of the winter season in November.

UTILITY CONSTRUCTION

The Contractor will construct utility trenches in a manner that will not direct runoff toward wetlands resources or to drainage system structures.

STABILIZATION ACTIVITIES

All disturbed surfaces will be stabilized a maximum of 14 days after construction on any portion of the project site that is completed or is temporarily halted, unless additional construction is intended to be initiated within 21 days. The Contractor will not disturb more area than can be stabilized within 14 days unless the area is to remain active. The Contractor will not disturb more area than can be stabilized within the same construction season.

SLOPE STABILIZATION

The smallest practicable area of land will be exposed at a time. Slopes greater than three-to-one (horizontal to vertical) will be stabilized with seed, organic mulch, jute fabric, or rip-rap, as appropriate, to prevent erosion during construction. After disturbed areas have been stabilized, the temporary erosion control measures will be removed, and accumulated sediment will be removed and disposed of in an appropriate location. Disturbed areas will be stabilized with appropriate ground cover as soon as possible. After the removal of temporary erosion control measures, disturbed areas will receive a layer of topsoil for stabilization.

STABILIZED CONSTRUCTION ENTRANCE

Temporary stabilized construction entrances may be installed at the project site. The purpose of the stabilized construction entrance is to remove sediment attached to vehicle tires and to minimize sediment transport and deposition onto public road surfaces. The construction entrances will be composed of beds of crushed stone which will be replenished as necessary to maintain their proper function.

Construction Period Pollution Prevention

GOOD HOUSEKEEPING BMPS

The following good housekeeping practices will be followed onsite during the construction project:

- An effort will be made to store only enough product required to do the job.

- All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Whenever possible, all of a product will be used up before disposing of the container.
- Manufacturer's recommendations for proper use and disposal will be followed.
- The site superintendent will inspect daily to ensure proper use and disposal of materials.
- The contractor will be required in the Contract documents to control dust.

Material Handling & Waste Management

HAZARDOUS PRODUCTS

These practices will be used to reduce the risks associated with hazardous materials. Material Safety Data Sheets (MSDSs) for each substance with hazardous properties that is used on the job site will be obtained and used for the proper management of potential wastes that may result from these products. An MSDS will be posted in the immediate area where such product is stored and/or used and another copy of each MSDS will be maintained in the SWPPP file at the job site construction office. Since work is located adjacent to wetland resource areas, hazardous fuels or other potential contaminants shall not be stored on site. Each employee who must handle a substance with hazardous properties will be instructed on the use of MSDS sheets and the specific information in the applicable MSDS for the product they are using, particularly regarding spill control techniques.

- Products will be kept in original containers unless they are not re-sealable.
- Original labels and material safety data will be retained, as they contain important product information.
- Manufacturer, local state, and/or federal recommended methods for proper disposal will be followed if surplus product must be disposed of.

HAZARDOUS WASTE

All hazardous waste material will be disposed of by the Contractor in the manner specified by local, state, and/or federal regulations and by the manufacturer of such products. Site personnel will be instructed in these practices by the job site superintendent, who will also be responsible for seeing that these practices are followed.

SOLID AND CONSTRUCTION WASTES

All waste materials will be collected and stored in accordance with state and federal law in an appropriately covered container and/or securely lidded metal dumpster.

All trash and construction debris from the site will be deposited in the dumpster. No construction waste materials will be buried on site. All personnel will be instructed regarding the correct procedures for waste disposal.

All waste dumpsters and roll-off containers will be located in an area where the likelihood of the containers contributing to storm water discharges is negligible. If required, additional BMPs must be implemented, such as sandbags around the base, to prevent wastes from contributing to storm water discharges.

SANITARY WASTES

All sanitary waste will be collected from the portable units as required to maintain proper operation and sanitary conditions of these units. All maintenance work on portable sanitation units shall be performed by a licensed portable facility provider in complete compliance with local and state regulations.

All sanitary waste units will be located in an area where the likelihood of the unit contributing to storm water discharges is negligible. If required, additional BMPs must be implemented, such as sandbags around the base, to prevent wastes from contributing to storm water discharges.

Spill Prevention & Control Plan

The Contractor will train all personnel in the proper handling and cleanup of spilled materials. No spilled hazardous materials or hazardous wastes will be allowed to come in contact with storm water discharges. If such contact occurs, the storm water discharge will be contained on site until appropriate measures in compliance with state and federal regulations are taken to dispose of such contaminated storm water. It shall be the responsibility of the job site superintendent to properly train all personnel in spill prevention and clean up procedures.

In order to minimize the potential for a spill of hazardous materials to come into contact with storm water, the following steps will be implemented:

- All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, cleaning solvents, additives for soil stabilization, concrete curing compounds and additives, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.
- During construction, liquid petroleum products and other hazardous materials with the potential to contaminate groundwater may not be stored or handled in areas of the site draining to an infiltration area. An “infiltration area” is any area of the site that by design or as a result of soils, topography and other relevant factors accumulates runoff that infiltrates into the soil. Dikes, berms, sumps, and other forms of secondary containment that prevent discharge to groundwater may be used to isolate portions of the site for the purposes of storage and handling of these materials.
- The minimum practical quantity of all such materials will be kept on the job site.

- A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the storage site.
- Manufacturers recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

In the event of a spill, the following procedures should be followed:

- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with the hazardous substances.
- The project manager and the Engineer of Record will be notified immediately.
- Spills of toxic or hazardous materials will be reported to the appropriate federal, state, and/or local government agency, regardless of the size of the spill.
- If the spill exceeds a Reportable Quantity, the SWPPP must be modified within seven (7) calendar days of knowledge of the discharge to provide a description of the release, the circumstances leading to the release, and the date of the release. The plans must identify measures to prevent the recurrence of such releases and to respond to such releases.

The job site superintendent will be the spill prevention and response coordinator. He/She will designate the individuals who will receive spill prevention and response training. These individuals will each become responsible for a particular phase of prevention and response. The names of these personnel will be posted in the material storage area and in the office trailer on-site.

Allowable Non-Stormwater Discharge Management

Certain types of discharges are allowed under the NPDES General Permit for Construction Activity and it is the intent of this project to allow such discharges. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come into contact with the water prior to or after its discharge. The control measures that have been outlined previously in this report will be strictly followed to ensure that no contamination of these non-stormwater discharges takes place. The following non-stormwater discharges that may occur from the job site include:

- Discharges from fire-fighting activities
- Fire hydrant flushing
- Waters used to wash vehicles where detergents are not used
- Water used to control dust in accordance with off-site vehicle tracking
- Potable water including uncontaminated water line flushing
- Routine external building wash down that does not use detergents
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used
- Uncontaminated air conditioner compressor condensate

- Uncontaminated ground water or spring water
- Foundation or footing drains where flows are not contaminated with process materials such as solvents
- Uncontaminated excavation dewatering
- Landscape irrigation

The Project disturbs one or more acres of land; therefore, the project contractor will request coverage under the NPDES Construction General Permit (CGP) and develop a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP follows the requirements of this standard and is in compliance with the NPDES CGP.

Standard 9: O&M Plan

A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

MassDOT O&M plans are addressed at a statewide, programmatic level through the State's highway operation and maintenance program. Each MassDOT district office is responsible for providing operation and maintenance for the MassDOT stormwater management systems within their respective jurisdictions. Appendix F includes the O&M Plan for this project.

Standard 10: Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

Standard 10 of the Massachusetts Stormwater Handbook prohibits illicit discharges to stormwater management systems. As stated in the handbook, "The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater."

Proponents of projects within Wetlands jurisdiction must demonstrate compliance with this requirement by submitting to the issuing authority an Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the site and by including in the pollution prevention plan measures to prevent illicit discharges to the stormwater management system.

Standard 10 also states that "The Illicit Discharge Compliance Statement must be accompanied by a site map that is drawn to scale and that identifies the location of any systems for conveying stormwater on the site and shows that these systems do not allow the entry of any illicit discharges into the stormwater management system. The site map shall identify the location of any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater management systems and the location of any measures taken to prevent the entry of illicit discharges into the stormwater management system." Included with the Notice of Intent Submission are construction plans that displays the location of all of the stormwater management components as well as other utilities (existing and proposed) on the project site and conforms to requirements of a "site map" to accompany the Illicit Discharge Compliance Statement.

An Illicit Discharge Compliance Statement is included in Appendix F – Illicit Discharge Compliance Statement of this Report.

Where a new, closed drainage system will be constructed, there will be no connections to sanitary sewer. In other areas, stormwater runoff discharges via overland flow.

The design plans submitted with this report have been designed in full compliance with Standard 10. The project area does not have any known illicit connections. Any illicit connections to the stormwater management system found in the project limit of work during construction will be removed and/or resolved through MassDOT's Illicit Discharge Detention and Elimination (IDDE) Program. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges. Appendix F includes the LTPPP for this project.

Appendix A: MassDEP Checklist for Stormwater Report

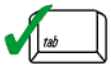
- Massachusetts Stormwater Report Checklist
- Redevelopment Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

6/28/2022

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

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Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Bioretention Basin

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

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Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

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Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

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Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

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Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☒ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

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Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☐ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Checklist for Redevelopment Projects

Redevelopment Location:
The entire work within the limit of disturbance is considered redevelopment.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

☒ Standard 1: (Untreated discharges)
No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

☐ Standard 2: (Peak rate control and flood prevention)
Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.

The proposed bridge will carry two 11-foot wide travel lanes, one in each direction, two 5-foot shoulders and two 5'-6" sidewalks on both sides. Work will also include installation of granite curb and concrete sidewalks. Butters Row will have a curb-to-curb width of 32'–0" with a total roadway width of 43'-0". It will carry two 11-foot travel lanes, one in each direction, 5-foot shoulders, and 5'-6" wide sidewalks (including curb). This results in an overall increase of 73,900 square feet in impervious area. The increase in impervious area correlates to a minor overall increase in peak flow rates. Increases in peak flow rate are seen at DP-4 and DP-5 for the 2-, 10-, and 100-year storm event and at DP-2 for the 10- and 100-year storm event. The increase to the peak rates is attributed to the addition of impervious area for the sidewalks and collecting runoff in a closed drainage system that currently discharges via overland flow. Implementations of stormwater Best Management Practices (BMPs) for peak rate attenuation were used for one discharge point but are not practicable for all discharge points due to the limited space within the existing Right-Of-Way (ROW), adjacent wetlands, existing utilities and high seasonal groundwater elevations.

☐ Standard 3: (Recharge to Ground water)
Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The project considered implementation of BMP's that would provide recharge and there was only one (1) feasible location in the project. Given the limited space within the ROW, underground utilities, high groundwater elevations, mature trees, and proximity to wetlands, it was not feasible to propose BMP's in all the drainage areas in the project.

For the proposed BMP, the contributing impervious areas and their underlying Hydrologic Soil Groups were used to estimate the recharge volume lost by development, which was used as the required recharge volume for the given BMP. The recharge volume provided by the BMP is 2,112 CF which is less than the project-wide required recharge volume of 2,592 CF, but exceeds required recharge volume for the net increase in impervious area of 1,010 CF. Therefore, Standard 3 was met to the maximum extent practicable.

☐ Standard 4: (80% TSS Removal)

Stormwater management systems must be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained;*
b. *Stormwater BMPs are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The only way to meet 80% TSS removal is with the installation of particle separators or structural BMPs at each outfall. This approach is neither practical nor cost effective due to the close proximity of adjacent wetlands, mature trees, and limited available area within the ROW.

The bioretention basin will be able to achieve 89% TSS removal with the sediment forebay and the catch basins with deep sumps and hoods providing pretreament.

Where the proposed drainage system is unable to be routed to an infiltration BMP before outfalling, the proposed drainage system will be able to achieve 25% TSS removal with the installation of catch basins with deep sumps and hoods reconfigured in off-line series. This is an improvement over the existing conditions where the majority of runoff sheet flows directly into wetlands providing with little to no treatment. These systems will be maintained on a regular basis as outlined in the Operations and Maintenance Plan.

☒ Standard 5 (Higher Potential Pollutant Loads (HPPL)

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and stormwater runoff, the proponent shall use the specific stormwater BMPs determined by the Department to be suitable for such use as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53, and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Not Applicable.

☐ Standard 6 (Critical Areas)

Stormwater discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or any other critical area require the use of the specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts

Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters or Special Resource Waters shall be set back from the receiving water and receive the highest and best practical method of treatment. A "stormwater discharge," as defined in 314 CMR 3.04(2)(a)1. or (b), to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of the public water supply.

The entire project is located within a Zone II. Therefore, Standard 6 is applicable to the proposed project. The project proposes one infiltrating stormwater BMP that will improve water quality by providing groundwater recharge and helps with peak rate attenuation. The infiltrating BMP is a bioretention basin. The BMP has adequate pretreatment by use of a forebay. Also, throughout the project catch basin with deep sumps and hood will be installed to provide additional TSS removal. It is anticipated that there will be no adverse effects to the Zone II.

Additional measures required for stormwater management systems in critical areas are the installation of shut-off valves at all outlets to a critical area. For the closed drainage system, the risk of potential tampering by the public with the shut-off valves and the required response time by a town official to operate the valve in case of an emergency outweigh the benefits of installing the shut-off valves; therefore, they are not included in the design.

☒ Standard 8: (Erosion, Sediment Control)
A plan to control construction-related impacts, including erosion sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan), must be developed and implemented.

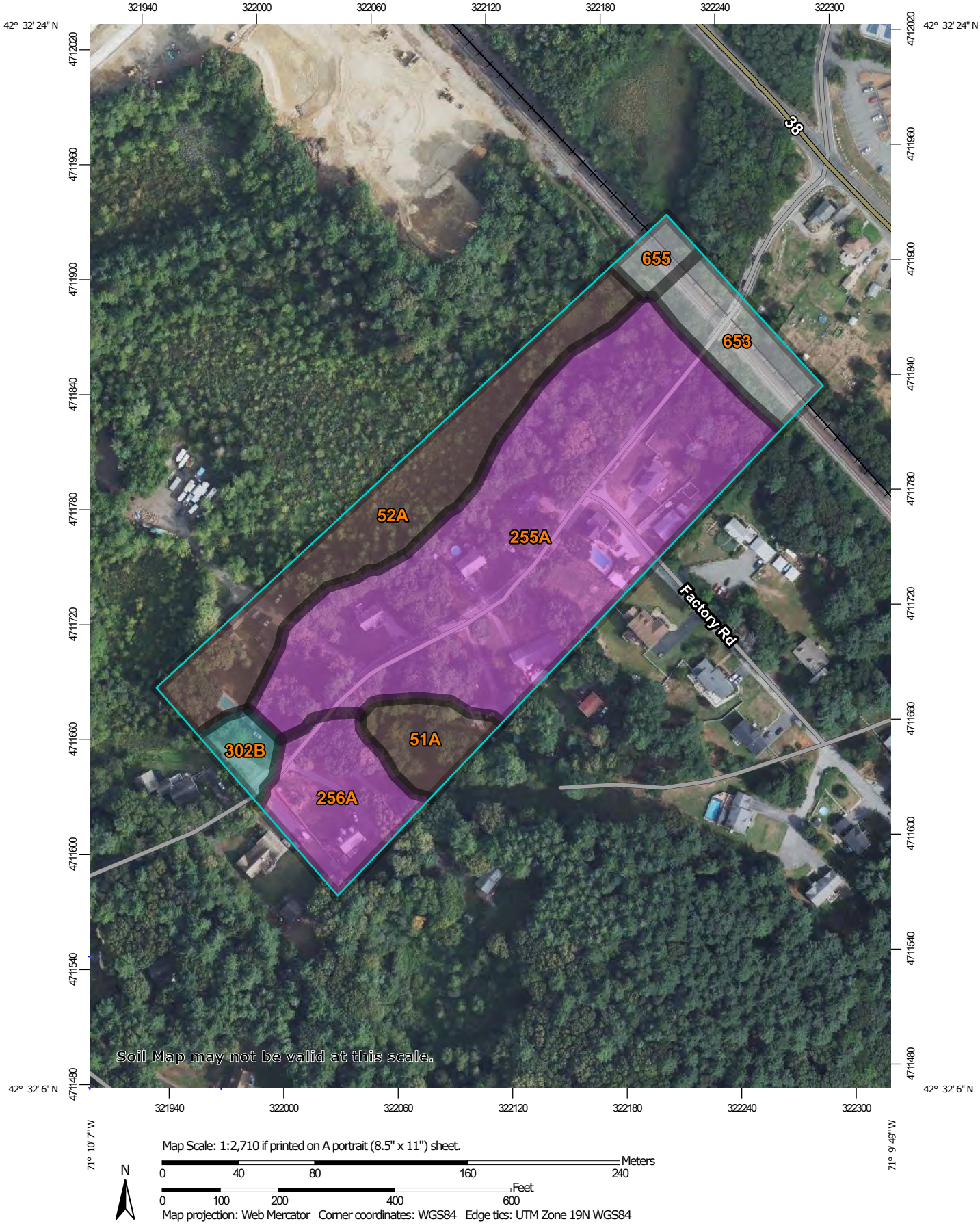
☒ Standard 9: (Operation and Maintenance)
A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed.

☒ Standard 10 (Illicit Discharges)
All illicit discharges to the stormwater management system are prohibited.

Appendix B: Soils and FEMA Information

- NRCS Soil Survey Information
- On-Site Subsurface Investigations
- FEMA Flood Insurance Rate Map (FIRM)

Hydrologic Soil Group—Middlesex County, Massachusetts



Map Scale: 1:2,710 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	B/D	0.6	4.8%
52A	Freetown muck, 0 to 1 percent slopes	B/D	2.3	19.3%
255A	Windsor loamy sand, 0 to 3 percent slopes	A	6.6	54.9%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	1.2	9.7%
302B	Montauk fine sandy loam, 0 to 8 percent slopes, extremely stony	C	0.3	2.4%
653	Udorthents, sandy		0.8	6.8%
655	Udorthents, wet substratum		0.3	2.1%
Totals for Area of Interest			**12.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Data Report

for

Massachusetts Department of Transportation – Highway Division

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Project File No. 608051

BMP & Test Pit Results

for

State Route 38 (Main Street)

Wilmington, Massachusetts

Date: 8/26/2020

Prepared for:
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, Massachusetts 01886
Phone: 978-923-0400

Prepared by:
Lamson Engineering Corporation
437 Cherry Street, Room # 109
Newton, Massachusetts 02465
Phone: 617-558-0101

TABLE OF CONTENTS

INTRODUCTION

The purpose of this Data Report is to present the results of 2020 BMP (Best Management Practices) boring and test pit exploration program for the State Route 38 (Main Street) project in the Town of Wilmington, Massachusetts

2020 Subsurface Exploration Program

A subsurface exploration program consisting of test borings BH-1 to BH-3 and test pits TP-1 to TP-6 was completed in August 2020 for the proposed Route 38 project, as indicated on Appendix 2, 'As-Drilled BMP & As-Dug Test Pit Location Plan'.

Borings BH-1 to BH-3 were conducted by using all-terrain vehicle (ATV) drilling. Test Pits TP-1 to TP-6 were conducted by using Mini Excavator.

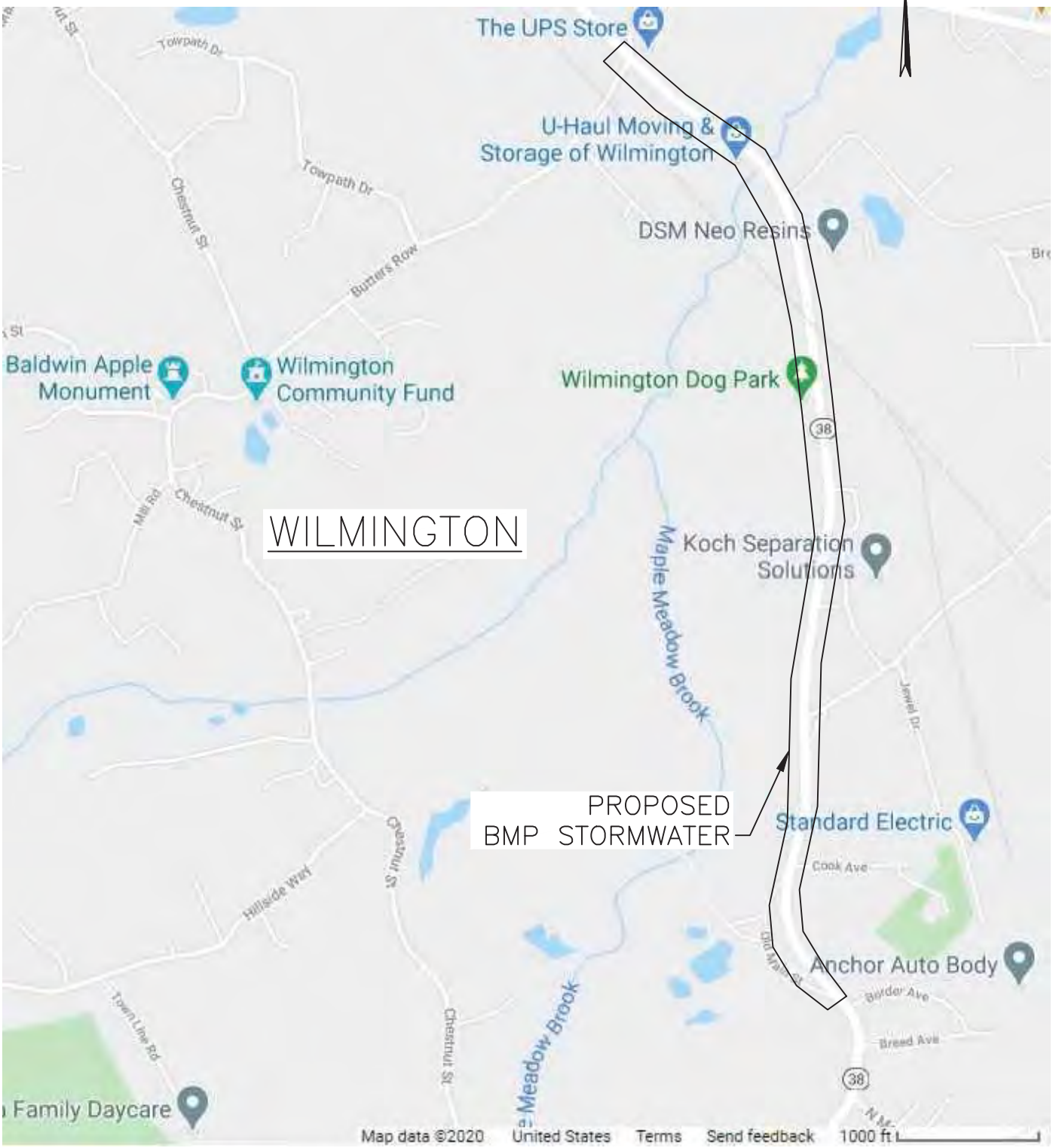
The exploration was performed between August 07 and August 12, 2020 by New England Boring Contractors located on 40 Fordway Street, Derry, New Hampshire (Phone: 603-437-1610). The monitoring of boring exploration was performed by Lamson Engineering Corporation. Materials recorded on the boring logs were visually identified at the site by an engineer from Lamson Engineering, who is also involved in the preparation of this report.

The soil samples were taken using a 2" outside diameter split spoon sampler driven 24" into the soil by a 140-pound hammer falling 30". Blows per 6" were recorded. The visual classification of the collected sample materials at the site was included on the boring logs.

APPENDIX 1

Project Location Plan

(1 Sheet)



massDOT Highway

GREEN INTERNATIONAL AFFILIATES, INC.
PROJECT FILE NO.: 608051
STATE ROUTE 38 (MAIN STREET)
WILMINGTON, MASSACHUSETTS

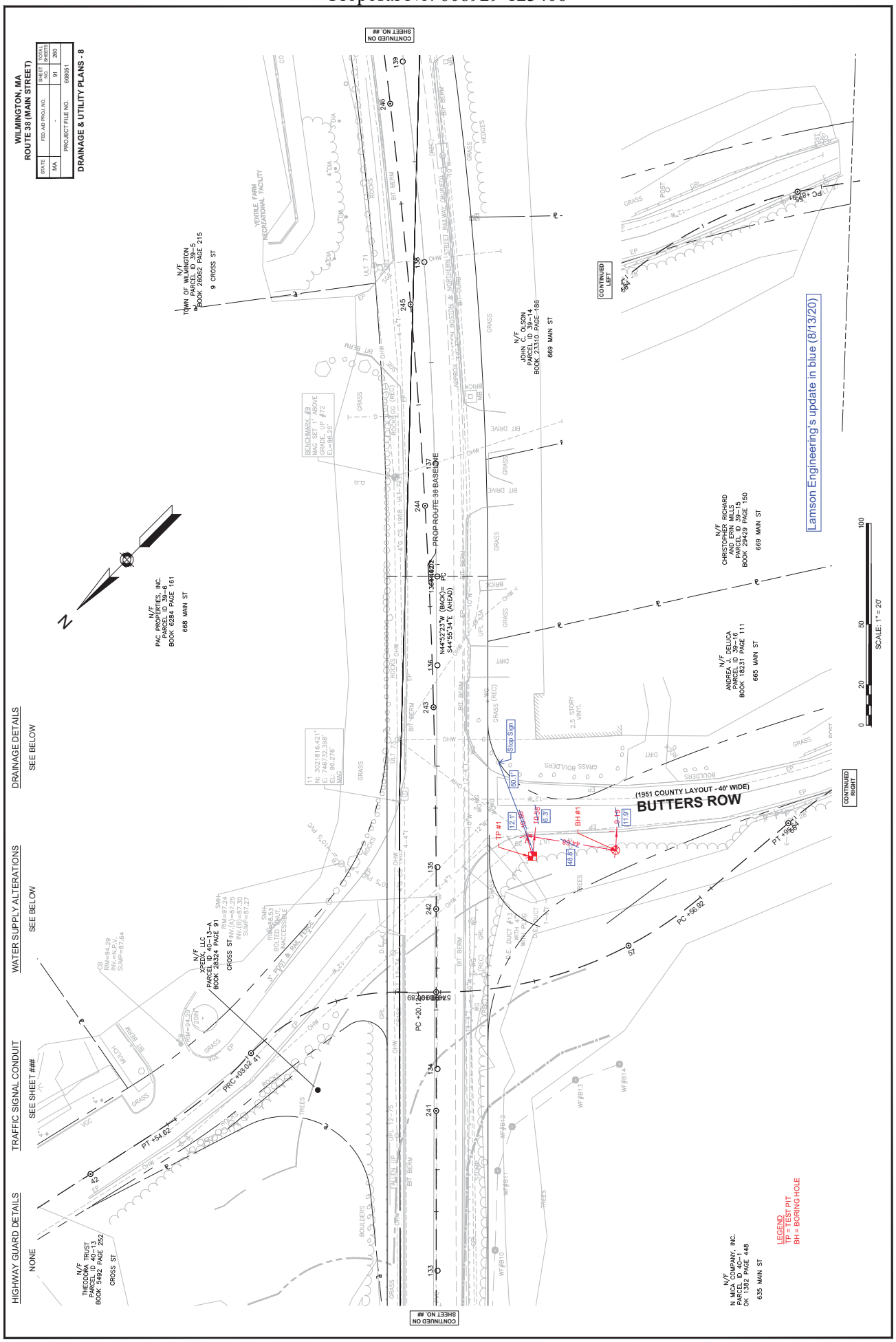
PROJECT LOCATION PLAN
AS NOTED

PREPARED BY
LAMSON ENGINEERING CORP.
NEWTON, MASS.

APPENDIX 2

As-Drilled BMP & As-Dug Test Pit Location Plan

(5 Sheets)


WILMINGTON, MA
ROUTE 38 (MAIN STREET)
DRAINAGE & UTILITY PLANS - 8
STATE: MA
FED. AID PROJ. NO.: -
PROJECT FILE NO.: 608051
SHEET NO.: 91
TOTAL SHEETS: 260
HIGHWAY GUARD DETAILS: NONE
TRAFFIC SIGNAL CONDUIT: SEE SHEET ###
WATER SUPPLY ALTERATIONS: SEE BELOW
DRAINAGE DETAILS: SEE BELOW
PROP ROUTE 38 BASELINE
(1951 COUNTY LAYOUT - 40' WIDE)
BUTTERS ROW
Stop Sign
TP #1
BH #1
Lamson Engineering's update in blue (8/13/20)
SCALE: 1" = 20'
LEGEND
TP = TEST PIT
BH = BORING HOLE
CONTINUED ON SHEET NO. ##
CONTINUED LEFT
CONTINUED RIGHT
N/F TOWN OF WILMINGTON PARCEL ID 39-5 BOOK 26062 PAGE 215 9 CROSS ST
N/F JOHN K. OLSON PARCEL ID 39-14 BOOK 23310 PAGE 186 669 MAIN ST
N/F CHRISTOPHER J. RICHARD AND ERIN MILLS PARCEL ID 39-15 BOOK 29429 PAGE 150 669 MAIN ST
N/F ANDREA J. DELUCA PARCEL ID 39-16 BOOK 18231 PAGE 111 685 MAIN ST
N/F PAC PROPERTIES, INC. PARCEL ID 39-16 BOOK 6284 PAGE 161 668 MAIN ST
N/F XPEDX, LLC PARCEL ID 40-13-A BOOK 28324 PAGE 91 CROSS ST
N/F THEODORA TRUST PARCEL ID 40-13 BOOK 5492 PAGE 252 CROSS ST
N/F N. MICA COMPANY, INC. PARCEL ID 40-1 OK 1382 PAGE 448 635 MAIN ST
BENCHMARK #9 MAG SET 1" ABOVE GRADE, UP #72 EL=96.28
PC +89.01
PC +20.16
PRC +69.02
PT +54.62
PC +56.92
PT +39.64
N44°52'23"W (BACK)= S44°55'34"E (AHEAD)
YENTILE FARM RECREATIONAL FACILITY
2.5 STORY VINYL
GRASS BOULDERS
BOULDERS
TREES
WF#B10
WF#B11
WF#B12
WF#B13
WF#B14

APPENDIX 3

Boring & Test Pit Logs

(9 Sheets)

Note:

- For 2020 boring and test pit locations see Appendix 1, 'As-Drilled BMP & As-Dug Test Pit Location Plan'.
- There are 3 sheets for Borings BH-1, BH-2, and BH-3.
- There are 6 sheets for Test Pits TP-1, TP-2, TP-3, TP-4, TP-5, and TP-6.
- The elevations shown on the attached 2020 logs are based on 1988 NAVD datum.

Moving Massachusetts Forward massDOT Highway

Boring Log

LAMSON ENGINEERING CORPORATION

437 Cherry Street, #109, Newton, Massachusetts 02465
Phone: (617) 558-0101 E-Mail: Lamsoneng@msn.com

Boring No. BH-1 (BMP Boring) | Page 1/1

Scale: 1" = 3'

City/Town: Wilmington	Bridge No.: -	Project File No.: 608051	Contract No.: -
Location: State Route 38 (Main Street)		Date & Time Started: 8/12/20 8:30 a.m.	Total Hours:
Groundwater Depth (Feet): 10' Date & Time: 8/12/20 11:30 a.m.		Date & Time Completed: 8/12/20 12:00 p.m.	3.5
Coordinates: N 3,021,757 E 746,635	Ground Elevation (Feet): 94.5'	Inspector's Name: Weijie Dong	
Drilling Company: New England Boring Contractors		Driller's Name: Manlea Thompson	Helper's Name: Will Sebigny

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches (Coring Times Minute Per Foot)	Recovery (inches)	Field Description	Strata Changes
S-1	0' - 2'	2 3 7 8	10"	Grass O Layer 1" Dry, loose, dark brown, LOAMY SAND, some vegetation. 4"	A Layer
				Dry, medium dense, brown, FINE SAND, some fine to medium gravel, trace inorganic silt.	B Layer
S-2	2' - 2'5"	120/5"	3"	Dry, loose, brown, FINE SAND, trace inorganic silt.	2'5"
				Boulder	3'7"
S-3	4' - 6'	1 1 3 3	12"	Dry, loose, brown, FINE SAND, trace inorganic silt.	
S-4	6' - 8'	7 6 7 9	9"	Dry, medium dense, brown, FINE SAND, trace inorganic silt.	B Layer
S-5	8' - 10'	12 11 11 11	12"	Dry, medium dense, brown, FINE SAND, trace inorganic silt.	
S-6	10' - 12'	6 17 21 16	11"	Wet, dense, brown, FINE TO COARSE SAND, some fine to coarse gravel, trace inorganic silt.	
S-7	12' - 13'6"	23 20 125	14"	Wet, dense, brown, FINE TO COARSE SAND, some fine to coarse gravel, trace inorganic silt.	13'
				Top of Possible Bedrock @ 13'6" 13'6"	C Layer
				Rollerbit into possible bedrock.	R Layer 15'
				Bottom of Exploration @ 15'	

Legend:
O Layer = Organic Surface Layer
A Layer = Surface Layer
B Layer = Subsoil
C Layer = Substratum
R Layer = Bedrock

Notes:

Arrow-Board: N/A
Signs: -
Cones: 12

Protective Device Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide:

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
N=Sum of Second and Third 6" Blow Counts		Hard	Over 30

Type of Drill Rig: ATV Mobile B-57
Hammer Weight: 140 lbs Fall: 30"
Casing Types: HW
Size: 4"
Depth: 12'
Sampler Type: S/S Size: 1 3/8" ID
Automatic Hammer Weight: 140 lbs
Safety Hammer Weight:
Donut Hammer Weight: Fall: 30"
Core Barrel Type: - Size: -

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

APPENDIX 4

Test Pit Lab Testing Results

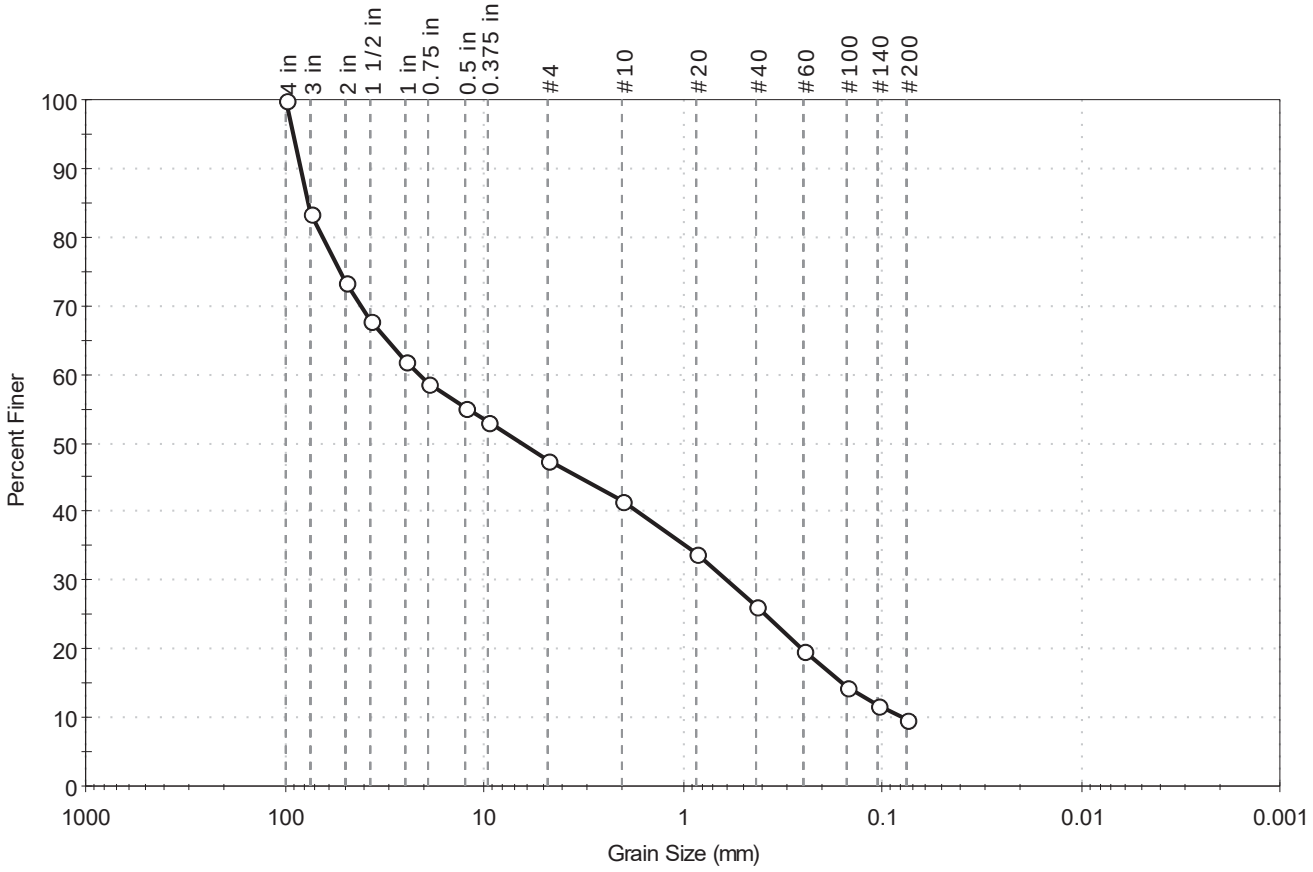
(6 Sheets)

Note:

- Soil samples (5-gal bucket) taken for testing are obtained from test pits TP-1 to TP-6.

Client:	Lamson Engineering Corporation				
Project:	Project File No. 608051				
Location:	Wilmington, MA			Project No:	GTX-312218
Boring ID:	---	Sample Type:	bucket	Tested By:	ckg
Sample ID:	TP-1	Test Date:	08/24/20	Checked By:	bfs
Depth :	1-4 ft	Test Id:	572208		
Test Comment:	---				
Visual Description:	Moist, olive brown sand with silt and gravel				
Sample Comment:	Sample contains asphalt				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
16.4	36.2	37.7	9.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
4 in	100.00	100		
3 in	75.00	84		
2 in	50.00	73		
1 1/2 in	37.50	68		
1 in	25.00	62		
0.75 in	19.00	59		
0.5 in	12.50	55		
0.375 in	9.50	53		
#4	4.75	47		
#10	2.00	42		
#20	0.85	34		
#40	0.42	26		
#60	0.25	20		
#100	0.15	14		
#140	0.11	12		
#200	0.075	9.7		

Coefficients

D_{85} = 76.8674 mm	D_{30} = 0.5903 mm
D_{60} = 21.3072 mm	D_{15} = 0.1595 mm
D_{50} = 6.5479 mm	D_{10} = 0.0795 mm
C_u = 268.015	C_c = 0.206

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (1))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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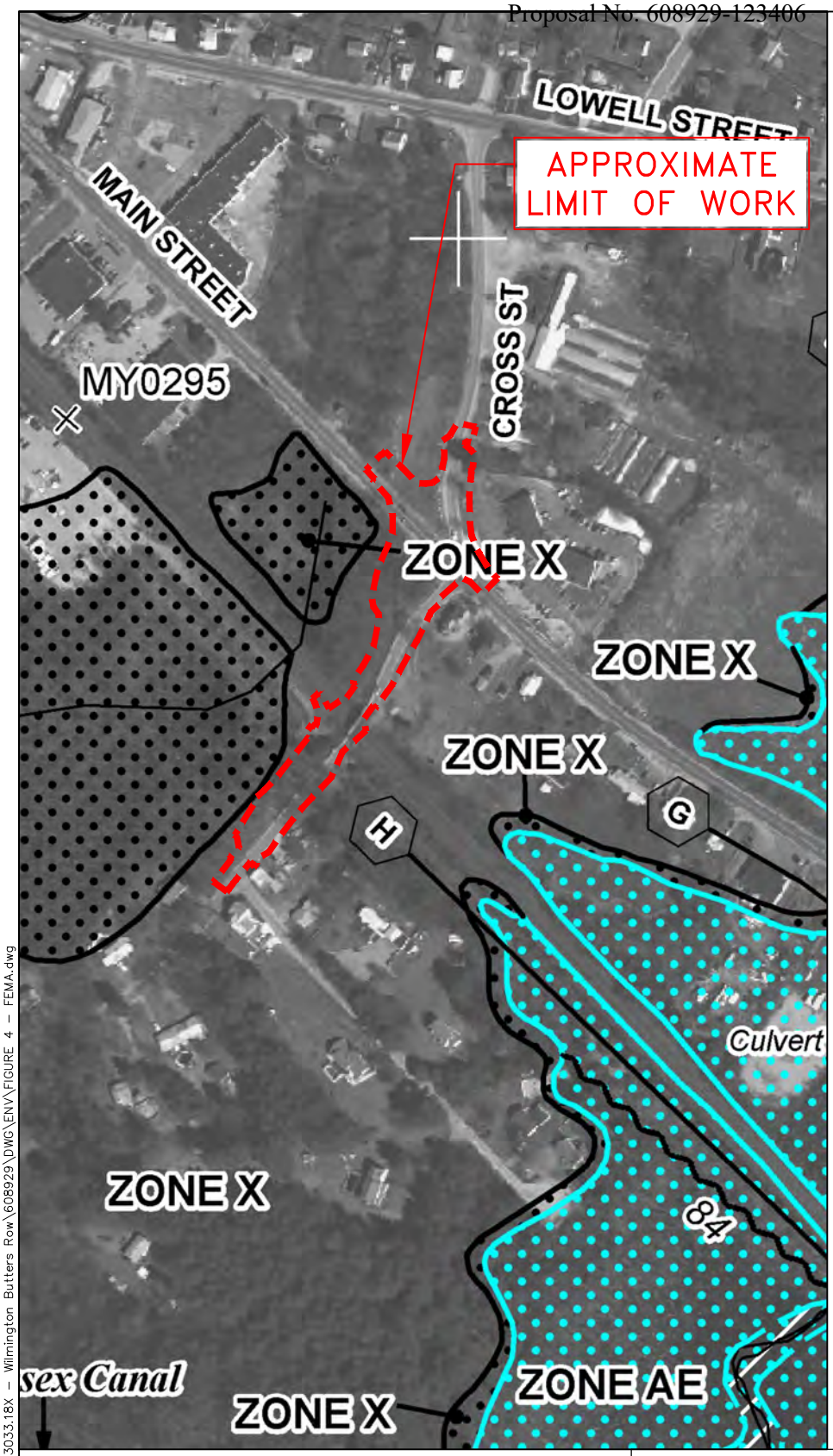

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4276000 FT N — 1000-meter Universal Transverse Mercator grid values, zone 19
- 600000 FT — 5000-foot grid values: Massachusetts State Plane coordinate system, Mainland zone (FIPSZONE 2001), Lambert Conformal Conic projection
- DX5510 x — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
June 4, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

LEGEND

APPROXIMATE LIMIT OF WORK

SCALE IN FEET
150 0 150 300
1" = 300'

NOTE:
THE FLOOD ZONE DATA SHOWN IS TAKEN FROM THE FEDERAL INSURANCE RATE MAPS (FIRM) FOR THE TOWN OF WILMINGTON, MA. (FIRM COMMUNITY PANEL 25017C0291E, DATED 06/04/2010.)

FEMA MAP

BRIDGE REPLACEMENT
BRIDGE NO. W-38-003 (2NV), BUTTERS ROW OVER MBTA
WILMINGTON, MA, PROJECT #608929

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
239 LITTLETON RD, WESTFORD, MA (978) 923-0400
24 ALBION RD, LINCOLN, RI (401) 305-7895

PREPARED FOR:
massDOT
Massachusetts Department of Transportation
Highway Division

SCALE: AS NOTED	PROJECT NO. 13033.18X	FIGURE 4
DATE: 6/21/2022	DRAWN BY: OF	
REVISED:	CHECKED BY: MC	

Y:\Shared\Engineering\Projects\2013\13033\13033.18X - Wilmington Butters Row\608929\DWG\ENV\FIGURE 4 - FEMA.dwg

Appendix C: MassDOT Water Quality Data Form

75% Design Water Quality Data Form

v. 08/2014

Project Information

The following questions should be filled out at the 75% design stage following consultation with the MassDOT Environmental Section and selection of the stormwater BMPs that will be implemented at the site.

WARNING: Do not attempt to cut and paste cells or alter cell formats. Form will malfunction.

1. **Have you downloaded the most recent version of the Water Quality Data Form?**

   Yes

For questions 2-5, please use MassDOT's Project Information Look-Up Website to populate the yellow fields.

2. **Project Number (From Project Info Website):**

   608929

3. **Project Type (From Project Info Website):**

   Bridge

4. **Project Name (From Project Info Website):**

   WILMINGTON- BRIDGE REPLACEMENT, W-38-003, BUTTERS ROW OVER MBTA

5. **Location of Project (From Project Info Website):**

   Project Road(s): Butters Row
   Cities and/or Towns: Wilmington
   District Number: 4

6. **Project Designer:**

   Design Firm: Green International Affiliates, Inc.
   Contact Person for Follow-Up: Danielle Spicer, P.E.
   Email Address for Follow-Up: dspicer@greenintl.com
   Phone Number for Follow-Up: 978-923-0400 **Extension:**

BMPs Implemented at the Site

7. **What is the WPA filing for this project?**

   Bridge Exempt

8. **How much impervious area (sq. ft.) is being added to or removed from existing conditions for the entire project? (Answer should be negative if impervious area is removed)**

   23,130

9. **Select which, if any, non-structural stormwater BMPs will be implemented on site:**

   - ☐ Preserved as much of the pre-development vegetation as possible
   - ☑ Preserved natural drainage patterns and riparian buffers
   - ☐ Minimized disturbance to wetland resource areas
   - ☐ Reduced or eliminated curbing in well-vegetated areas that gently slope downward and away from the road
   - ☐ Used shallow, grassed roadside swales and parking lot islands with check dams instead of curb and gutter storm drainage systems
   - ☐ Reduced existing impervious cover or minimized the construction of additional impervious cover

10. **How many water bodies on MassDEP's *Year 2012 Integrated List of Waters* receive stormwater runoff from the area impacted by this project (via any combination of piped or over land flow)?**

    1

BMPs Implemented for Water Body #1

11. Segment ID of the receiving listed water body:

MA92-04

Name of the receiving listed water body:

Maple Meadow Brook

Receiving water body status:

Impairment Not Caused By Pollutant

12a. Number of BMPs treating stormwater that drains to Water Body 1 (Maple Meadow Brook):

1

12b. List details about the BMPs:

	BMP ID or Description	Existing or Proposed	Latitude	Longitude	BMP Ownership	BMP Watershed (WS) Area Information: Impervious WS (sq. ft.)	Pervious WS (sq. ft.)	Total WS (sq. ft.)	Type of BMP Installed
1	Bioretention Basin #1	Proposed	42.53939	-71.16409	MassDOT	17,703	6,604	24,307	Bioretention Basin

13. How many new deep sump catch basins will be constructed to treat stormwater that drains to Water Body 1 (Maple Meadow Brook)?

8

14. Describe areas where site constraints prevent the installation of BMPs, and provide any additional notes relevant to stormwater, if applicable:

The project design minimizes impacts to wetland resource areas and minimizes increases in impervious areas to the maximum extent practicable. A bioretention basin is proposed south of the Route 38/Butters Row intersection to mitigate the increase in impervious surfaces resulting from this project and to treat stormwater runoff before discharging to the east into the existing Wetland C-B at DP-2.

Appendix D: Supporting Calculations

- Recharge Volume Calculations
- Water Quality Calculations
- TSS Removal Calculations
- Pretreatment Calculations
- HydroCAD Storage Tables

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

RECHARGE VOLUME CALCULATIONS

Date: June 28, 2022
Revised:
Project: Butters Row Bridge Replacement
Project No: 13033.18 #608929
Location: Wilmington, MA - BMP1 (Butters Row)

Prepared By: BV/MW
Checked By: JT/DHS

Recharge Volume Design

Objective: Size infiltration BMPs that will approximate the annual recharge from the existing. This project is a redevelopment and is required to meet this Standard (3) to the maximum extent practicable.

Methodology: MA Department of Environmental Protection (DEP) Massachusetts Stormwater Handbook (Vol.3, Ch.1)

Design Criteria:

The required recharge volume equals a depth of runoff corresponding to the soil type times the net increase in impervious areas covering that soil type at the post-development site.

Based on the Site Hydrologic Soil Group:

Hydrologic Soil Gro	Soil Texture	Target Depth Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

The soils are defined by the Soil Conservation Services (SCS) Soil Survey of Suffolk County of Massachusetts.

Required Drawdown Time: Maximum of 72 Hours using the following equation:

$$\text{Drawdown Time} = \frac{R_v}{(K \times A_{Bot})}$$

R_v = Required Recharge Volume
K = Permeability Rate
A_{Bot} = Bottom area of basin

Calculation Results:

Designation	Volume Required Total (cf)	Volume Required Net (cf)	Volume Provided (cf)
For Entire Project Site	**2,592**	**1,010**	**2,112**

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Recharge Volume Calculations

Required: **Recharge Required based on Total Impervious Area**

Hydrologic Soil Group	Proposed Impervious Area (sf)*	Target Depth	Volume Required (cf)
A	51,846	0.60	2,592
B		0.35	0
C		0.25	0
D		0.10	0
Total	51,846		**2,592**

* The existing impervious area is 31,644 sf within the LOW, so there is a net increase of 23,109 sf.

Required: **Recharge Required based on Net Impervious Area**

Hydrologic Soil Group	Net Impervious Area (sf)*	Target Depth	Volume Required (cf)
A	20,202	0.60	1,010
B		0.35	0
C		0.25	0
D		0.10	0
Total	20,202		**1,010**

Provided: **Sum of BMP's**
METHOD USED: STATIC

R_v = combined storage below lowest outlets for all BMP's : **2,112** cf

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

RECHARGE VOLUME CALCULATIONS

Date: June 28, 2022
Revised:
Project: Butters Row Bridge Replacement
Project No: 13033.18 #608929
Location: Wilmington, MA - BMP1 (Butters Row)

Prepared By: BV/MW
Checked By: JT/DHS

Recharge Volume Design

Objective: Size infiltration BMPs that will approximate the annual recharge from the existing conditions.

Methodology: MA Department of Environmental Protection (DEP) Massachusetts Stormwater Handbook (Vol.3, Ch.1)

Design Criteria:

The required recharge volume equals a depth of runoff corresponding to the soil type times the increase in impervious areas covering that soil type at the post-development site.

Based on the Site Hydrologic Soil Group:

Hydrologic Soil Group	Soil Texture	Target Depth Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

The soils are defined by the Soil Conservation Services (SCS) Soil Survey of Middlesex County of Massachusetts. This watershed is comprised of 'A' soils.

Required Drawdown Time: Maximum of 72 Hours using the following equation:

$$\text{Drawdown Time} = \frac{R_v}{(K x A_{Bot})}$$

R_v = Required Recharge Volume
K = Permeability
A_{Bot} = Bottom area of basin

Calculation Results:

Designation	Volume Required (cf)	Volume Provided (cf)
Bioretention Basin	**885**	**2,112**

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Recharge Volume Required: **Total Recharge Required**

Hydrologic Soil Group	Proposed Impervious Area (sf)	Target Depth	Volume Required (cf)
A	17,703	0.60	885
B	0	0.35	0
C	0	0.25	0
D	0	0.10	0
Total	17,703		**885**

Recharge Volume Provided: **METHOD USED:** STATIC

Drainage Area to Bioretention Basin

R_v = storage below lowest outlet (orifice) = **2,112** cf (Elev. 93.00*)

A_{Bot} = bottom area (irregular) = 1,314 sf (Elev. 90.50*)

*See HydroCAD table

R_v cf	K in/hr	A_{Bot} sf	Drawdown Time Hours		
2,112	2.41	1,314	**8.00**	**<**	**72 Hours**

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

WATER QUALITY CALCULATIONS

Date: June 28, 2022
Revised:
Project: Butters Row Bridge Replacement
Project No: 13033.18 #608929
Location: Wilmington, MA **- Overall**

Prepared By: BV/MW
Checked By: JT/DS

Objective: To determine the required Water Quality Volume (WQV) for adaqute stormwater treatment. This project is a redevelopment and is required to meet this Standard (4) to the maximum extent practicable.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 3, Ch. 1)

Design Criteria: Volume to be treated =1.0" x Post Development Impervious Area

Critical Areas (include ORW, ACEC, recharge areas for public water supplies (Zone Is, Zone IIs and Interim Wellhead Protection Areas for ground water sources and Zone As for surface water sources), bathing beaches, cold water fisheries, shellfish growing areas and LUHPPL's

All WQ calculations use 1" since the site is located within a Zone II

Calculation results:

Designation	Volume Required Total (cf)	Volume Required Net (cf)	Volume Provided (cf)
Treatment Volume	**4,321**	**1,684**	**2,112**

Treatment Volume Required:

Required Treatment Volume for Total Post-Construction Impervious Area

Total Proposed Impervious Area: **51,846** **sf**
Total Volume to be treated: **4,321** **cf**

Treatment Volume Required:

Required Treatment Volume for Net Increase in Impervious Area

Total Proposed Impervious Area: **20,202** **sf**
Total Volume to be treated: **1,684** **cf**

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Total Treatment Volume Provided:

Total Treatment Volume Provided

WQ_v = combined storage below lowest outlet = **2,112 cf** Elev. 93 (lowest orifice) from HydroCAD table

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

WATER QUALITY CALCULATIONS

Date: June 28, 2022
Revised:
Project: Butters Row Bridge Replacement
Project No: 13033.18 #608929
Location: Wilmington, MA - BMP1 (Butters Row)

Prepared By: BV/MW
Checked By: JT/DS

Objective: To determine the required Water Quality Volume (WQV) for adaqute stormwater treatment. This project is a redevelopment and is required to meet this Standard (4) to the maximum extent practicable.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 3, Ch. 1)

Design Criteria: Volume to be treated =1.0" x Post Development Impervious Area

Critical Areas (include ORW, ACEC, recharge areas for public water supplies (Zone Is, Zone IIs and Interim Wellhead Protection Areas for ground water sources and Zone As for surface water sources), bathing beaches, cold water fisheries, shellfish growing areas and LUHPPL's

Volume to be treated = 1.0" x Post Development Impervious Area

All WQ calculations use 1" since the site is located within a Zone II

Calculation results:

Designation	Volume Required (cf)	Volume Provided (cf)
Bioretention Basin	**1,475**	**2,112**

Volume & Area Required:

Drainage to BMP1

Total Proposed Impervious Area: 17,703 sf
Total Treatment Volume: **1,475 cf**

Volume Provided:

Drainage to BMP1

WQ_v = storage below lowest outlet= **2,112 cf** (Elev. 93.00,see HydroCAD table)

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Wilmington Butters Row BMP1 to DP-2

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	**0.25**	**1.00**	**0.25**	**0.75**
Bioretention Area	**0.90**	**0.75**	**0.68**	**0.08**
Deep Sump and Hooded Catch Basin	**0.25**	**0.08**	**0.02**	**0.06**
	0.00	**0.06**	**0.00**	**0.06**
	0.00	**0.06**	**0.00**	**0.06**

Total TSS Removal = **94%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **13033.18 #608929**
Prepared By: **BV/MW**
Date: **6/29/2022**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Wilmington Route 38 DP-2, 4

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**
	0.00	**0.75**	**0.00**	**0.75**

Total TSS Removal = **25%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **13033.18 #608929**

Prepared By: **BV/MW**

Date: **6/29/2022**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

PRETREATMENT CALCULATION

Date: June 28, 2022
Revised:
Project: Butters Row Bridge Replacement
Project No: 13033.18 #608929
Location: Wilmington, MA - BMP1 (Butters Row)

Prepared By: BV/MW
Checked By: JT/DS

Objective: To determine the required pretreatment Volume for adaqute stormwater treatment. This project is a redevelopment and is required to meet this Standard (4) to the maximum extent practicable.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 2, Ch. 2)

Design Criteria: Volume to be treated = (0.1" x Post Development Impervious Area)

All WQ calculations use 1" since the site is located within a Zone II

Calculation results:

Designation	Volume Required (cf)	Volume Provided (cf)
Drainage to Forebay of BMP1	**148**	**410**

Volume to be Treated:

Drainage to Forebay of BMP1

Total Proposed Impervious Area: 17,703 sf
Total Treatment Volume: **148 cf**

Volume Provided:

Forebay of BMP1

Top Elevation = 93.50 Area of contour = 450 sf
Bottom Elev = 92.00 Area of contour = 96 sf Volume of storage: 410 cf

Dewatering check:

Volume cf	K in/hr	A_{Bot} sf	Time Hours		
410	2.41	96	**21.24**	**<**	**72 Hours**

Proposed Condition *Type III 24-hr 100y24h Rainfall=8.23"*

Prepared by Bryan Vachon - Green International Affiliates Printed 6/27/2022

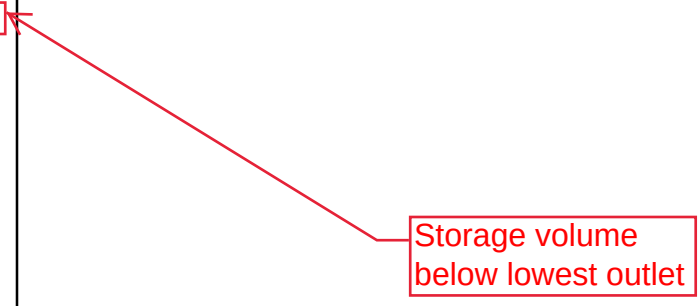
Stage-Area-Storage for Pond BMP1: Bioretention Area

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
90.50	0	91.02	205	91.54	410
90.51	4	91.03	209	91.55	414
90.52	8	91.04	213	91.56	418
90.53	12	91.05	217	91.57	422
90.54	16	91.06	221	91.58	426
90.55	20	91.07	225	91.59	430
90.56	24	91.08	229	91.60	434
90.57	28	91.09	233	91.61	438
90.58	32	91.10	237	91.62	442
90.59	35	91.11	240	91.63	445
90.60	39	91.12	244	91.64	449
90.61	43	91.13	248	91.65	453
90.62	47	91.14	252	91.66	457
90.63	51	91.15	256	91.67	461
90.64	55	91.16	260	91.68	465
90.65	59	91.17	264	91.69	469
90.66	63	91.18	268	91.70	473
90.67	67	91.19	272	91.71	477
90.68	71	91.20	276	91.72	481
90.69	75	91.21	280	91.73	485
90.70	79	91.22	284	91.74	489
90.71	83	91.23	288	91.75	493
90.72	87	91.24	292	91.76	497
90.73	91	91.25	296	91.77	501
90.74	95	91.26	300	91.78	505
90.75	99	91.27	304	91.79	509
90.76	102	91.28	307	91.80	512
90.77	106	91.29	311	91.81	516
90.78	110	91.30	315	91.82	520
90.79	114	91.31	319	91.83	524
90.80	118	91.32	323	91.84	528
90.81	122	91.33	327	91.85	532
90.82	126	91.34	331	91.86	536
90.83	130	91.35	335	91.87	540
90.84	134	91.36	339	91.88	544
90.85	138	91.37	343	91.89	548
90.86	142	91.38	347	91.90	552
90.87	146	91.39	351	91.91	556
90.88	150	91.40	355	91.92	560
90.89	154	91.41	359	91.93	564
90.90	158	91.42	363	91.94	568
90.91	162	91.43	367	91.95	572
90.92	166	91.44	371	91.96	576
90.93	170	91.45	374	91.97	579
90.94	173	91.46	378	91.98	583
90.95	177	91.47	382	91.99	587
90.96	181	91.48	386	92.00	591
90.97	185	91.49	390	92.01	604
90.98	189	91.50	394	92.02	618
90.99	193	91.51	398	92.03	631
91.00	197	91.52	402	92.04	644
91.01	201	91.53	406	92.05	657

Proposed Condition *Type III 24-hr 100y24h Rainfall=8.23"*
Prepared by Bryan Vachon - Green International Affiliates Printed 6/27/2022

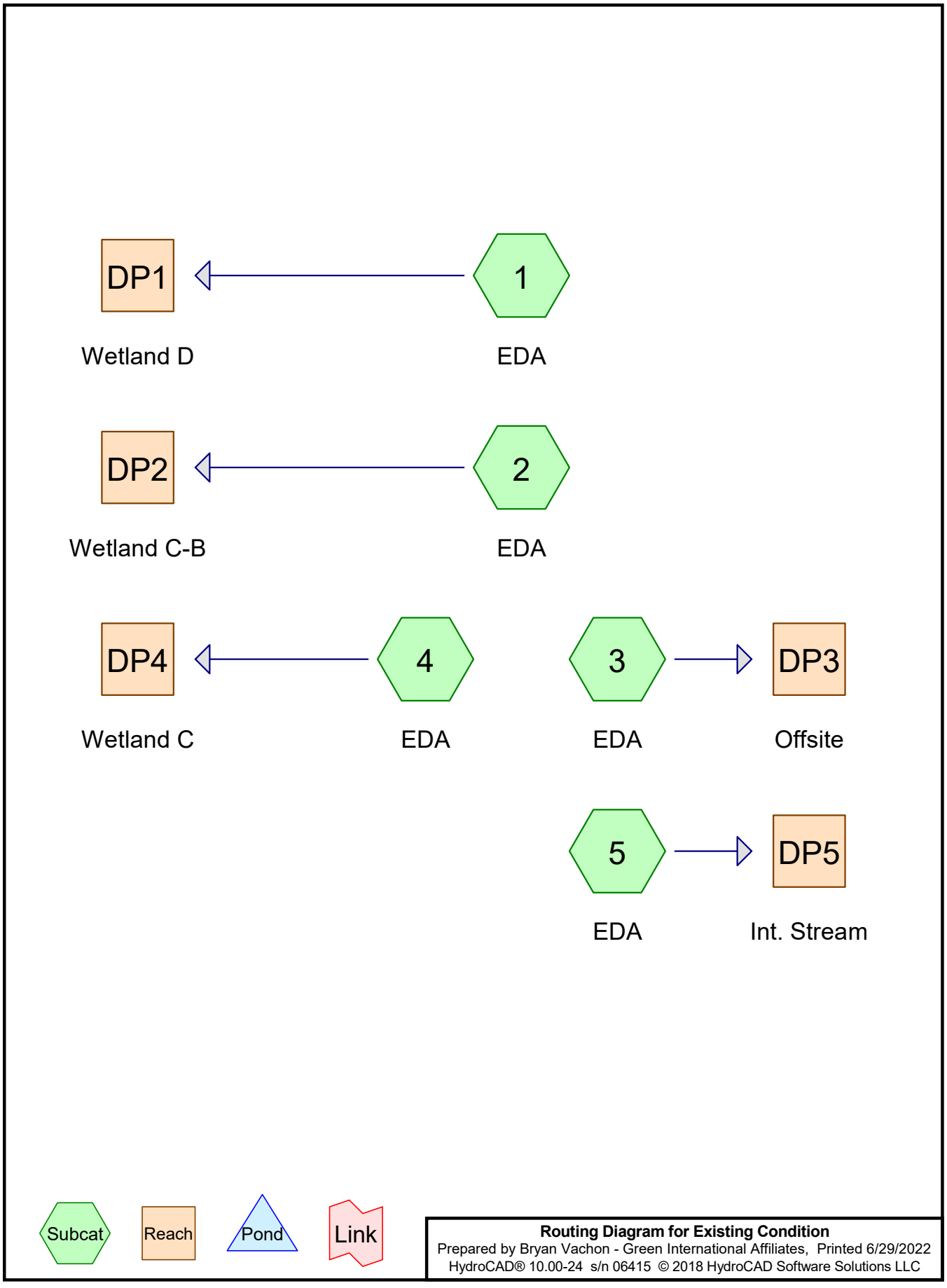
Stage-Area-Storage for Pond BMP1: Bioretention Area (continued)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
92.06	671	92.58	1,422	93.10	2,288
92.07	684	92.59	1,437	93.11	2,306
92.08	698	92.60	1,453	93.12	2,324
92.09	711	92.61	1,468	93.13	2,342
92.10	725	92.62	1,484	93.14	2,360
92.11	738	92.63	1,500	93.15	2,378
92.12	752	92.64	1,516	93.16	2,396
92.13	765	92.65	1,531	93.17	2,414
92.14	779	92.66	1,547	93.18	2,432
92.15	793	92.67	1,563	93.19	2,450
92.16	807	92.68	1,579	93.20	2,468
92.17	820	92.69	1,595	93.21	2,487
92.18	834	92.70	1,611	93.22	2,505
92.19	848	92.71	1,627	93.23	2,524
92.20	862	92.72	1,643	93.24	2,542
92.21	876	92.73	1,659	93.25	2,560
92.22	890	92.74	1,675	93.26	2,579
92.23	904	92.75	1,692	93.27	2,598
92.24	918	92.76	1,708	93.28	2,616
92.25	932	92.77	1,724	93.29	2,635
92.26	946	92.78	1,741	93.30	2,654
92.27	961	92.79	1,757	93.31	2,672
92.28	975	92.80	1,774	93.32	2,691
92.29	989	92.81	1,790	93.33	2,710
92.30	1,003	92.82	1,807	93.34	2,729
92.31	1,018	92.83	1,823	93.35	2,748
92.32	1,032	92.84	1,840	93.36	2,767
92.33	1,047	92.85	1,857	93.37	2,786
92.34	1,061	92.86	1,873	93.38	2,805
92.35	1,076	92.87	1,890	93.39	2,824
92.36	1,090	92.88	1,907	93.40	2,843
92.37	1,105	92.89	1,924	93.41	2,863
92.38	1,120	92.90	1,941	93.42	2,882
92.39	1,134	92.91	1,958	93.43	2,901
92.40	1,149	92.92	1,975	93.44	2,921
92.41	1,164	92.93	1,992	93.45	2,940
92.42	1,179	92.94	2,009	93.46	2,960
92.43	1,194	92.95	2,026	93.47	2,979
92.44	1,208	92.96	2,043	93.48	2,999
92.45	1,223	92.97	2,060	93.49	3,018
92.46	1,238	92.98	2,077	93.50	**3,038**
92.47	1,253	92.99	2,095		
92.48	1,268	93.00	2,112		
92.49	1,284	93.01	2,129		
92.50	1,299	93.02	2,147		
92.51	1,314	93.03	2,164		
92.52	1,329	93.04	2,182		
92.53	1,345	93.05	2,199		
92.54	1,360	93.06	2,217		
92.55	1,375	93.07	2,235		
92.56	1,391	93.08	2,252		
92.57	1,406	93.09	2,270		



Appendix E: Hydraulic and Hydrologic Data

- Existing Conditions HydroCAD Calculations
- Proposed Conditions HydroCAD Calculations


DP1
1
Wetland D
EDA
DP2
2
Wetland C-B
EDA
DP4
4
3
DP3
Wetland C
EDA
EDA
Offsite
5
DP5
EDA
Int. Stream
Subcat
Reach
Pond
Link
Routing Diagram for Existing Condition
Prepared by Bryan Vachon - Green International Affiliates, Printed 6/29/2022
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Existing Condition

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.739	49	50-75% Grass cover, Fair, HSG A (1, 3, 4, 5)
0.517	69	50-75% Grass cover, Fair, HSG B (2)
0.007	76	Gravel roads, HSG A (4)
0.000	85	Gravel roads, HSG B (2)
0.552	98	Paved roads w/curbs & sewers, HSG A (1, 3, 4, 5)
0.175	98	Paved roads w/curbs & sewers, HSG B (2)
1.989	**72**	**TOTAL AREA**

Existing Condition

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.297	HSG A	1, 3, 4, 5
0.692	HSG B	2
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.989		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: EDA Runoff Area=21,363 sf 51.17% Impervious Runoff Depth=1.10"
Tc=6.0 min CN=74 Runoff=0.60 cfs 0.045 af

Subcatchment 2: EDA Runoff Area=30,134 sf 25.28% Impervious Runoff Depth=1.22"
Tc=6.0 min CN=76 Runoff=0.95 cfs 0.070 af

Subcatchment 3: EDA Runoff Area=7,863 sf 51.27% Impervious Runoff Depth=1.10"
Tc=6.0 min CN=74 Runoff=0.22 cfs 0.017 af

Subcatchment 4: EDA Runoff Area=18,736 sf 27.09% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=63 Runoff=0.21 cfs 0.020 af

Subcatchment 5: EDA Runoff Area=8,550 sf 46.64% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=72 Runoff=0.21 cfs 0.016 af

Reach DP1: Wetland D Inflow=0.60 cfs 0.045 af
Outflow=0.60 cfs 0.045 af

Reach DP2: Wetland C-B Inflow=0.95 cfs 0.070 af
Outflow=0.95 cfs 0.070 af

Reach DP3: Offsite Inflow=0.22 cfs 0.017 af
Outflow=0.22 cfs 0.017 af

Reach DP4: Wetland C Inflow=0.21 cfs 0.020 af
Outflow=0.21 cfs 0.020 af

Reach DP5: Int. Stream Inflow=0.21 cfs 0.016 af
Outflow=0.21 cfs 0.016 af

Total Runoff Area = 1.989 ac Runoff Volume = 0.169 af Average Runoff Depth = 1.02"
63.48% Pervious = 1.263 ac 36.52% Impervious = 0.726 ac